This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

KEY

KEY

TO

SCHOOL CLASS BOOK OF ARITHMETIC.

PART II.

Cambridge:
PRINTED BY C. J. CLAY, M.A.
AT THE UNIVERSITY PRESS.

KEY

TO

SCHOOL CLASS BOOK

OF

ARITHMETIC.

PART II.

BY

BARNARD SMITH, M.A.

RECTOR OF GLASTON, RUTLAND, LATE FELLOW AND SENIOR BURSAR OF ST PETER'S COLLEGE, CAMBRIDGE.

Cambridge and London:

MACMILLAN AND CO.

1865.

1802 f 97 6

BODLEIAN LIBRARY
27 JUL 91
OXFORD

SOLUTIONS, &c.

PART II.

GREATEST COMMON MEASURE.

Ex. I. Page 4.

1. (1) $15\overline{)24}\,(1$, $\underline{15}$; $9\overline{)15}\,(1$, $\underline{9}$; $6\overline{)9}\,(1$, $\underline{6}$; $3\overline{)6}\,(2$, $\underline{6}$.

$\therefore$ 3 is G. C. M.

(2) $20\overline{)36}\,(1$, $\underline{20}$; $16\overline{)20}\,(1$, $\underline{16}$; $4\overline{)16}\,(4$, $\underline{16}$.

$\therefore$ 4 is G. C. M.

(3) $35\overline{)75}\,(2$, $\underline{70}$; $5\overline{)35}\,(7$, $\underline{35}$.

$\therefore$ 5 is G. C. M.

(4) $30\overline{)44}\,(1$, $\underline{30}$; $14\overline{)30}\,(2$, $\underline{28}$; $2\overline{)14}\,(7$, $\underline{14}$.

$\therefore$ 2 is G. C. M.

(5) $42\overline{)81}\,(1$, $\underline{42}$; $39\overline{)42}\,(1$, $\underline{39}$; $3\overline{)39}\,(13$, $\underline{39}$.

$\therefore$ 3 is G. C. M.

(6) $63\overline{)147}\,(2$, $\underline{126}$; $21\overline{)63}\,(3$, $\underline{63}$.

$\therefore$ 21 is G. C. M.

(7) $90 \overline{)105}\,(1$, 90, $\overline{15}$; $15 \overline{)90}\,(6$, 90.

$\therefore$ 15 is G. C. M.

(8) $325 \overline{)403}\,(1$, 325, $\overline{78}$; $78 \overline{)325}\,(4$, 312, $\overline{13}$; $13 \overline{)78}\,(6$, 78.

$\therefore$ 13 is G. C. M.

(9) $348 \overline{)1024}\,(2$, 696, $\overline{328}$; $328 \overline{)348}\,(1$, 328, $\overline{20}$; $20 \overline{)328}\,(16$, 20, $\overline{128}$, 120, $\overline{8}$; $8 \overline{)20}\,(2$, 16, $\overline{4}$; $4 \overline{)8}\,(2$, 8.

$\therefore$ 4 is G. C. M.

(10) $132 \overline{)189}\,(1$, 132, $\overline{57}$; $57 \overline{)132}\,(2$, 114, $\overline{18}$; $18 \overline{)57}\,(3$, 54, $\overline{3}$; $3 \overline{)18}\,(6$, 18.

$\therefore$ 3 is G. C. M.

(11) $532 \overline{)1274}\,(2$, 1064, $\overline{210}$; $210 \overline{)532}\,(2$, 420, $\overline{112}$; $112 \overline{)210}\,(1$, 112, $\overline{98}$; $98 \overline{)112}\,(1$, 98, $\overline{14}$; $14 \overline{)98}\,(7$, 98.

$\therefore$ 14 is G. C. M.

(12) 235) 371 (1
235
136) 235 (1
136
99) 136 (1
99
37) 99 (2
74
25) 37 (1
25
12) 25 (2
24
1) 12 (12
12

∴ 1 is G. C. M.

(13) 576) 1088 (1
576
512) 576 (1
512
64) 512 (8
512

∴ 64 is G. C. M.

(14) 1905) 3175 (1
1905
1270) 1905 (1
1270
635) 1270 (2
1270

∴ 635 is G. C. M.

(15) 858) 996 (1
858
138) 858 (6
828
30) 138 (4
120
18) 30 (1
18
12) 18 (1
12
6) 12 (2
12

∴ 6 is G. C. M.

(16) 2209) 7921 (3
6627
1294) 2209 (1
1294
915) 1294 (1
915
379) 915 (2
758
157) 379 (2
314
65) 157 (2
130
27) 65 (2
54
11) 27 (2
22
5) 11 (2
10
1) 5 (1
5

∴ 1 is G. C. M.

(17) 2145) 3471 (1
2145
1326) 2145 (1
1326
819) 1326 (1
819
507) 819 (1
507
312) 507 (1
312
195) 312 (1
195
117) 195 (1
117
78) 117 (1
78
39) 78 (2
78

∴ 39 is G. C. M.

∴

(18) 6509) 7889 (1
6509
1380) 6509 (4
5520
989) 1380 (1
989
391) 989 (2
782
207) 391 (1
207
184) 207 (1
184
23) 184 (8
184

∴ 23 is G. C. M.

(19) 5252) 8484 (1
5252
3232) 5252 (1
3232
2020) 3232 (1
2020
1212) 2020 (1
1212
808) 1212 (1
808
404) 808 (2
808

∴ 404 is G. C. M.

(20) 8280) 11385 (1
8280
3105) 8280 (2
6210
2070) 3105 (1
2070
1035) 2070 (2
2070

∴ 1035 is G. C. M.

(21) 429) 15717 (36
1287
2847
2574
273) 429 (1
273
156) 273 (1
156
117) 15 (1
117
39) 117 (3
117

∴ 39 is G. C. M.

(22) 13536) 23148 (1
13536
9612) 13536 (1
9612
3924) 9612 (2
7848
1764) 3924 (2
3528
396) 1764 (4
1584
180) 396 (2
360
36) 180 (5
180

∴ 36 is G.C.M.

(23)
15032) 19400 (1
15032
4368) 15032 (3
13104
1928) 4368 (2
3856
512) 1928 (3
1536
392) 512 (1
392
120) 392 (3
360
32) 120 (3
96
24) 32 (1
24
8) 24 (3
24

∴ 8 is G. C. M.

(24) 143168) 2064888 (14
143168
633208
572672
60536) 143168 (2
121072
22096) 60536 (2
44192
16344) 22096 (1
16344
5752) 16344 (2
11504
4840

4840) 5752 (1
4840
912) 4840 (5
4560
280) 912 (3
840
72) 280 (3
216
64) 72 (1
64
8) 64 (8
64

∴ 8 is G. C. M.

2. (1) 8) 10 (1
8
2) 8 (4
8

∴ 2 is G. C. M.

2) 12 (6
12

∴ 2 is G. C. M. required.

(2) 12) 16 (1
12
4) 12 (3
12

∴ 4 is G. C. M.

4) 24 (6
24

∴ 4 is G. C. M. required.

(3) $8\overline{)28}\,(3$, 24, $\overline{4}\overline{)8}\,(2$, 8.

$\therefore$ 4 is G. C. M.

$4\overline{)38}\,(9$, 36, $\overline{2}\overline{)4}\,(2$, 4.

$\therefore$ 2 is G. C. M. required.

(4) $35\overline{)50}\,(1$, 35, $\overline{15}\overline{)35}\,(2$, 30, $\overline{5}\overline{)15}\,(3$, 15.

$\therefore$ 5 is G. C. M.

$5\overline{)75}\,(15$, 75.

$\therefore$ 5 is G. C. M.

$5\overline{)80}\,(16$, 80.

$\therefore$ 5 is G. C. M. required.

(5) $18\overline{)24}\,(1$, 18, $\overline{6}\overline{)18}\,(3$, 18.

$\therefore$ 6 is G. C. M.

$6\overline{)27}\,(4$, 24, $\overline{3}\overline{)6}\,(2$, 6.

$\therefore$ 3 is G. C. M.

$3\overline{)30}\,(10$, 30.

$\therefore$ 3 is G. C. M. required.

(6) $129\overline{)420}\,(3$, 387, $\overline{33}\overline{)129}\,(3$, 99, $\overline{30}\overline{)33}\,(1$, 30, $\overline{3}\overline{)30}\,(10$, 30.

$\therefore$ 3 is G. C. M.

$3 \mid \overline{903}$, $\overline{301}$.

$\therefore$ 3 is G. C. M. required.

(7) $492\overline{)1044}\,(2$, 984, $\overline{60}\overline{)492}\,(8$, 480, $\overline{12}\overline{)60}\,(5$, 60.

$\therefore$ 12 is G. C. M.

$12\overline{)744}\,(62$, 72, $\overline{24}$, 24.

$\therefore$ 12 is G. C. M. required.

(8) 333) 414 (1
338
81) 333 (4
324
9) 81 (9
81

∴ 9 is G. C. M.

9) 714 (79
63
84
81
3) 9 (3
9

∴ 3 is G. C. M. required.

(9) 504) 5292 (10
504
252) 504 (2
504

∴ 252 is G. C. M.

252) 1520 (6
1512
8) 252 (31
24
12
8
4) 8 (2
8

∴ 4 is G. C. M. required.

(10) 9768) 12408 (1
9768
2640) 9768 (3
7920
1848) 2640 (1
1848
792) 1848 (2
1584
264) 792 (3
792

∴ 264 is G. C. M.

264) 11616 (44
1056
1056
1056

∴ 264 is G.C.M. required.

3. 1 lb. Avoird. = 7000 grs. Troy.; 1 lb. Troy = 5760 grs. Troy.

5760) 7000 (1
5760
1240) 5760 (4
4960
800) 1240 (1
800
440) 800 (1
440
360) 440 (1
360
80) 360 (4
320
40) 80 (2
80

Ans. 40 grs.

4. £26. 15*s*. 6*d*. = 6426*d*.; £40. 8*s*. 6*d*. = 9702*d*.

6426) 9702 (1
6426
3276) 6426 (1
3276
3150) 3276 (1
3150
126) 3150 (25
252
630
630

G.C.M. is 126.

Now 126*d*. ÷ 12 = 10*s*. 6*d*.

∴ Ans. = Half-guineas.

5. 360) 400 (1
360
40) 360 (9
360

∴ 40 is G.C.M.

∴ 40, 20, 10, 8, 5, 4, 2, are common measures.

LEAST COMMON MULTIPLE.

Ex. II. Page 8.

1. (1) $10\overline{)15}\,(1$, $\underline{10}$; $5\overline{)10}\,(2$, $\underline{10}$.

$\therefore$ 5 is G.C.M. of 10 and 15;

$\therefore$ L.C.M. $= \frac{10 \times 15}{5} = \frac{150}{5} = 30.$

(2) $15\overline{)18}\,(1$, $\underline{15}$; $3\overline{)15}\,(5$, $\underline{15}$.

$\therefore$ 3 is G.C.M. of 15 and 18;

$\therefore$ L.C.M. $= \frac{15 \times 18}{3} = \frac{270}{3} = 90.$

(3) $20\overline{)24}\,(1$, $\underline{20}$; $4\overline{)20}\,(5$, $\underline{20}$.

$\therefore$ 4 is G.C.M. of 20 and 24;

$\therefore$ L.C.M. $= \frac{20 \times 24}{4} = \frac{480}{4} = 120.$

(4) $25\overline{)35}\,(1$, $\underline{25}$; $10\overline{)25}\,(2$, $\underline{20}$; $5\overline{)10}\,(2$, $\underline{10}$.

$\therefore$ 5 is G.C.M. of 25 and 35;

$\therefore$ L.C.M. $= \frac{25 \times 35}{5} = \frac{875}{5} = 175.$

(5) $42\overline{)72}\,(1$, $\underline{42}$; $30\overline{)42}\,(1$, $\underline{30}$; $12\overline{)30}\,(2$, $\underline{24}$; $6\overline{)12}\,(2$, $\underline{12}$.

$\therefore$ 6 is G.C.M. of 42 and 72;

$\therefore$ L.C.M. $= \frac{42 \times 72}{6} = \frac{3024}{6} = 504.$

(6) $5)18(3$, 15, $3)5(1$, 3, $2)3(1$, 2, 1.

$\therefore$ L. C. M. $= 5 \times 18 = 90$.

(7) $51)85(1$, 51, $34)51(1$, 34, $17)34(2$, 34.

$\therefore$ 17 is G. C. M. of 51 and 85;

$\therefore$ L. C. M. $= \frac{51 \times 85}{17} = \frac{4335}{17} = 255$.

(8) $75)120(1$, 75, $45)75(1$, 45, $30)45(1$, 30, $15)30(2$, 30.

$\therefore$ 15 is G. C. M. of 75 and 120;

$\therefore$ L. C. M. $= \frac{75 \times 120}{15} = \frac{9000}{15} = 600$.

(9) $96)256(2$, 192, $64)96(1$, 64, $32)64(2$, 64.

$\therefore$ 32 is G. C. M. of 96 and 256;

$\therefore$ L. C. M. $= \frac{96 \times 256}{32} = \frac{24576}{32} = 768$.

(10) $224)336(1$, 224, $112)224(2$, 224.

$\therefore$ 112 is G. C. M. of 224 and 336;

$\therefore$ L. C. M. $= \frac{224 \times 336}{112} = \frac{75264}{112} = 672$.

(11) $888\overline{)2775}\,(3$
2664
$\overline{111}\overline{)888}\,(8$
888

$\therefore$ 111 is G. C. M. of 888 and 2775;

$\therefore$ L. C. M. $\frac{888\times2775}{111}=\frac{2464200}{111}=22200.$

(12) $7056\overline{)7392}\,(1$
7056
$\overline{336}\overline{)7056}\,(21$
672
336
336

$\therefore$ 336 is G. C. M. of 7056 and 7392;

$\therefore$ L. C. M. $=\frac{7056\times7392}{336}=\frac{52157952}{336}=155232.$

(13)

$2145\overline{)3471}\,(1$
2145
$\overline{1326}\overline{)2145}\,(1$
1326
$\overline{819}\overline{)1326}\,(1$
819
$\overline{507}\overline{)819}\,(1$
507
$\overline{312}\overline{)507}\,(1$
312
$\overline{195}\overline{)312}\,(1$
195
$\overline{117}\overline{)195}\,(1$
117
$\overline{78}\overline{)117}\,(1$
78
$\overline{39}\overline{)78}\,(2$
78

$\therefore$ 39 is G. C. M. of 2145 and 3471;

$\therefore$ L. C. M. $=\frac{2145\times3471}{39}=\frac{7445295}{39}=190905.$

(14) $3575\overline{)125455}\,(35$
10725
$\overline{18205}$
17875
$\overline{330}\overline{)3575}\,(10$
330
$\overline{275}\overline{)330}\,(1$
275
$\overline{55}\overline{)275}\,(5$
275

$\therefore$ 55 is the G. C. M. of 3575 and 125455;

$$\therefore \text{L. C. M.} = \frac{3575 \times 125455}{55} = \frac{448501625}{55} = 8154575.$$

(15) $13536\overline{)23148}\,(1$
13536
$\overline{9612}\overline{)13536}\,(1$
9612
$\overline{3924}\overline{)9612}\,(2$
7848
$\overline{1764}\overline{)3924}\,(2$
3528
$\overline{396}\overline{)1764}\,(4$
1584
$\overline{180}\overline{)396}\,(2$
360
$\overline{36}\overline{)180}\,(5$
180

$\therefore$ 36 is G. C. M. of 13536 and 23148;

$$\therefore \text{L. C. M.} = \frac{13536 \times 23148}{36} = \frac{313331328}{36} = 8703648.$$

2. (1) $3 \mid \overline{4, 9, 12}$
$3, 4$
$\therefore$ L. C. M. $= 3 \times 3 \times 4 = 36.$

(2) $3 \mid \overline{6, 18, 15}$
$6, 5$
$\therefore$ L. C. M. $= 3 \times 6 \times 5 = 90.$

(3) $4 \mid 8, 20, 28$
$2, 5, 7$
$\therefore$ L. C. M. $= 4 \times 2 \times 5 \times 7 = 280.$

(4) $4 \mid 15, 20, 24$
$3 \mid 15, 5, 6$
$5, 2$
$\therefore$ L. C. M. $= 4 \times 3 \times 5 \times 2 = 120.$

(5) $5 \mid 25, 60, 45$
$3 \mid 5, 12, 9$
$5, 4, 3$
$\therefore$ L. C. M. $= 5 \times 3 \times 5 \times 4 \times 3 = 900.$

(6) $3 \mid 21, 33, 56$
$7 \mid 7, 11, 56$
$1, 11, 8$
$\therefore$ L. C. M. $= 3 \times 7 \times 11 \times 8 = 1848.$

(7) $7 \mid 63, 12, 84, 72$
$9, 12, 72$
$\therefore$ L. C. M. $= 7 \times 72 = 504.$

(8) $2 \mid 18, 32, 26, 96$
$13, 48$
$\therefore$ L. C. M. $= 2 \times 13 \times 48 = 1248.$

(9) $2 \mid 4, 9, 10, 14, 15, 18, 21$
$3 \mid 2, 9, 5, 7, 15, 9, 21$
$2, 5, 3, 7$
$\therefore$ L. C. M. $= 2 \times 3 \times 2 \times 5 \times 3 \times 7 = 1260.$

(10) $2 \mid 14, 18, 24, 35, 42, 68$
$3 \mid 9, 12, 35, 21, 34$
$2 \mid 3, 4, 35, 7, 34$
$3, 2, 35, 17$
$\therefore$ L. C. M. $= 2 \times 3 \times 2 \times 3 \times 2 \times 35 \times 17 = 42840.$

(11) $2 \mid 8, 12, 16, 24, 36, 54, 72, 144$
$9 \mid 27, 72$
$3, 8$
$\therefore$ L. C. M. $= 2 \times 9 \times 3 \times 8 = 432.$

(12)

2	24,	16,	8,	20,	8,	10,	30,	4,	25,	12
2	12,	8,		10,			15,		25,	
2	6,	4,		5,			15,		25,	
5	3,	2,					15,		25,	
		2,					3,		5,	

∴ L. C. M. $= 2 \times 2 \times 2 \times 5 \times 2 \times 3 \times 5 = 1200$.

(13)

4	760,	364,	336,	1736
7	190,	91,	84,	434
2	190,	13,	12,	62
	95,	13,	6,	31

∴ L. C. M. $= 4 \times 7 \times 2 \times 95 \times 13 \times 6 \times 31 = 12863760$.

(14)

10	10,	200,	550,	70400, 1000000
5			55,	7040, 100000
8			11,	1408, 20000
4				176, 2500
				44, 625

∴ L. C. M. $= 10 \times 5 \times 8 \times 4 \times 44 \times 625$
$= 44000000$.

3. G. C. M. of 8 and 10 is 2;

∴ L. C. M. of 8 and 10 $= \frac{8 \times 10}{2} = \frac{80}{2} = 40$.

G. C. M. of 40 and 12 is 4;

∴ L. C. M. of 40 and 12 $= \frac{40 \times 12}{4} = \frac{480}{4} = 120$.

∴ in 120 minutes from starting the boys will again meet.

1st boy will have walked round the field $\frac{120}{8}$ or 15 times,

2nd..... $\frac{120}{10}$ or 12 .....

3rd..... $\frac{120}{12}$ or 10 .....

4. 1 gallon = 8 pints, 1 barrel = 36 × 8 or 288 pints, 1 hogshead = 54 × 8 or 432 pints,

∴ find the L. C. M. of 1, 8, 36 and 432.

8	1, 8, 288, 432
9	36, 54
2	4, 6
	2, 3

∴ L. C. M. = 8 × 9 × 2 × 2 × 3 = 864;

∴ smallest cask required = 864 pints or 108 gallons.

5. Forewheel = 78 in.; hind wheel = 136 in.

G. C. M. of 78 and 136 is 2;

∴ L. C. M. of 78 and 136 = $\frac{78 \times 136}{2} = \frac{10608}{2} = 5304$;

∴ distance = 5304 in. = 442 ft.

In 10 miles this will happen $10 \times 1760 \times 3$, or $52800 \div 442$ times, or 119 times, rem. 202;

∴ *Ans.* = 119.

6.

2	8, 8, 15, 18, 25
5	4, 15, 9, 25
	4, 3, 9, 5

∴ L. C. M. = 2 × 5 × 4 × 9 × 5 = 1800.

Since the population is between 3000 and 4000 it must be $1300 \times 2 + 7 = 3600 + 7 = 3607$.

VULGAR FRACTIONS. Ex. III. Page 12.

1. $\frac{3}{13} \times 3 = \frac{9}{13}$; $\frac{3}{13} \times 4 = \frac{12}{13}$; $\frac{3}{13} \times 7 = \frac{21}{13}$; $\frac{3}{13} \times 8 = \frac{24}{13}$;
$\frac{3}{13} \times 22 = \frac{66}{13}$.

2. $\frac{32}{45} \times 5 = \frac{160}{45}$; $\frac{32}{45} \times 9 = \frac{288}{45}$; $\frac{32}{45} \times 13 = \frac{416}{45}$;
$\frac{32}{45} \times 26 = \frac{832}{45}$; $\frac{32}{45} \times 64 = \frac{2048}{45}$.

Ex. IV. Page 12.

1. $\frac{5}{7} \div 3 = \frac{5}{7 \times 3} = \frac{5}{21}$; $\frac{5}{7} \div 4 = \frac{5}{7 \times 4} = \frac{5}{28}$;

$\frac{5}{7} \div 7 = \frac{5}{7 \times 7} = \frac{5}{49}$; $\frac{5}{7} \div 15 = \frac{5}{7 \times 15} = \frac{5}{105}$;

$\frac{5}{7} \div 26 = \frac{5}{7 \times 26} = \frac{5}{182}$.

2. $\frac{13}{24} \div 2 = \frac{13}{24 \times 2} = \frac{13}{48}$; $\frac{13}{24} \div 11 = \frac{13}{24 \times 11} = \frac{13}{264}$;

$\frac{13}{24} \div 18 = \frac{13}{24 \times 18} = \frac{13}{432}$; $\frac{13}{24} \div 29 = \frac{13}{24 \times 29} = \frac{13}{696}$;

$\frac{13}{24} \div 56 = \frac{13}{24 \times 56} = \frac{13}{1344}$.

Ex. V. Page 13.

1. $6 = \frac{6}{1} = \frac{6 \times 2}{1 \times 2} = \frac{12}{2}$,

$6 = \frac{6}{1} = \frac{6 \times 7}{1 \times 7} = \frac{42}{7}$,

$6 = \frac{6}{1} = \frac{6 \times 13}{1 \times 13} = \frac{78}{13}$,

$6 = \frac{6}{1} = \frac{6 \times 26}{1 \times 26} = \frac{156}{26}$,

$11 = \frac{11}{1} = \frac{11 \times 2}{1 \times 2} = \frac{22}{2}$,

$11 = \frac{11}{1} = \frac{11 \times 7}{1 \times 7} = \frac{77}{7}$,

$11 = \frac{11}{1} = \frac{11 \times 13}{1 \times 13} = \frac{143}{13}$,

$11 = \frac{11}{1} = \frac{11 \times 26}{1 \times 26} = \frac{286}{26}$,

$$15=\frac{15}{1}=\frac{15\times2}{1\times2}=\frac{30}{2},$$

$$15=\frac{15}{1}=\frac{15\times7}{1\times7}=\frac{105}{7},$$

$$15=\frac{15}{1}=\frac{15\times13}{1\times13}=\frac{195}{13},$$

$$15=\frac{15}{1}=\frac{15\times26}{1\times26}=\frac{390}{26}.$$

2.

$$19=\frac{19}{1}=\frac{19\times13}{1\times13}=\frac{247}{13},$$

$$19=\frac{19}{1}=\frac{19\times53}{1\times53}=\frac{1007}{53},$$

$$19=\frac{19}{1}=\frac{19\times116}{1\times116}=\frac{2204}{116},$$

$$19=\frac{19}{1}=\frac{19\times257}{1\times257}=\frac{4883}{257},$$

$$24=\frac{24}{1}=\frac{24\times13}{1\times13}=\frac{312}{13},$$

$$24=\frac{24}{1}=\frac{24\times53}{1\times53}=\frac{1272}{53},$$

$$24=\frac{24}{1}=\frac{24\times116}{1\times116}=\frac{2784}{116},$$

$$24=\frac{24}{1}=\frac{24\times257}{1\times257}=\frac{6168}{257},$$

$$85=\frac{85}{1}=\frac{85\times13}{1\times13}=\frac{1105}{13},$$

$$85=\frac{85}{1}=\frac{85\times53}{1\times53}=\frac{4505}{53},$$

$$85=\frac{85}{1}=\frac{85\times116}{1\times116}=\frac{9860}{116},$$

$$85=\frac{85}{1}=\frac{85\times257}{1\times257}=\frac{21845}{257}.$$

Ex. VI. Page 15.

1. $\frac{8}{2}=4$. 2. $\frac{19}{3}=6\frac{1}{3}$. 3. $\frac{27}{5}=5\frac{2}{5}$. 4. $\frac{17}{12}=1\frac{5}{12}$.

5. $\frac{34}{5}=6\frac{4}{5}$. 6. $\frac{32}{11}=2\frac{10}{11}$. 7. $\frac{59}{21}=2\frac{17}{21}$.

8. $\frac{245}{9}=27\frac{2}{9}$. 9. $\frac{3216}{19}=169\frac{5}{19}$. 10. $\frac{276}{23}=12$.

11. $\frac{9672}{81}=119\frac{33}{81}$. 12. $\frac{1346}{289}=4\frac{190}{289}$. 13. $\frac{966}{858}=1\frac{108}{858}$.

14. $\frac{10000}{111}=90\frac{10}{111}$. 15. $\frac{35706}{384}=92\frac{378}{384}$.

16. $\frac{86400}{907}=95\frac{235}{907}$. 17. $\frac{107533}{26411}=4\frac{1889}{26411}$.

18. $\frac{5555555}{90009}=61\frac{65006}{90009}$. 19. $\frac{8450033}{200000}=42\frac{500033}{200000}$.

20. $\frac{51800000}{37000}=1400$.

Ex. VII. Page 16.

1. $1\frac{4}{5}=\frac{1\times5+4}{5}=\frac{9}{5}$. 2. $2\frac{3}{7}=\frac{2\times7+3}{7}=\frac{17}{7}$.

3. $3\frac{4}{9}=\frac{3\times9+4}{9}=\frac{31}{9}$. 4. $7\frac{5}{6}=\frac{7\times6+5}{6}=\frac{47}{6}$.

5. $18\frac{5}{8}=\frac{18\times8+5}{8}=\frac{149}{8}$. 6. $23\frac{7}{11}=\frac{23\times11+7}{11}=\frac{260}{11}$.

7. $14\frac{12}{13}=\frac{14\times13+12}{13}=\frac{194}{13}$.

8. $56\frac{3}{19}=\frac{56\times19+3}{19}=\frac{1067}{19}$.

9. $153\frac{5}{14}=\frac{153\times14+5}{14}=\frac{2147}{14}$.

10. $74\frac{54}{99} = \frac{74 \times 99 + 54}{99} = \frac{7380}{99}$.

11. $415\frac{1}{100} = \frac{415 \times 100 + 1}{100} = \frac{41501}{100}$.

12. $15\frac{3}{2000} = \frac{15 \times 2000 + 3}{2000} = \frac{30003}{2000}$.

13. $786\frac{29}{111} = \frac{786 \times 111 + 29}{111} = \frac{87275}{111}$.

14. $37\frac{5043}{9504} = \frac{3 \times 9504 + 7568}{9504} = \frac{36080}{9504}$.

15. $200\frac{5170}{8753} = \frac{200 \times 8753 + 5170}{8753} = \frac{1755770}{8753}$.

16. $500005\frac{1}{500005} = \frac{500005 \times 500005 + 1}{500005} = \frac{250005000026}{500005}$.

EX. VIII. Page 17.

1. $\frac{1}{3}$ of $\frac{6}{8} = \frac{1 \times 6}{3 \times 8} = \frac{1 \times \cancel{2} \times \cancel{3}}{\cancel{3} \times \cancel{2} \times 4} = \frac{1}{4}$.

2. $\frac{2}{3}$ of $\frac{3}{4} = \frac{2 \times \cancel{3}}{\cancel{3} \times 4} = \frac{2}{4} = \frac{\cancel{2}}{\cancel{2} \times 2} = \frac{1}{2}$.

3. $\frac{2}{7}$ of $\frac{5}{8} = \frac{2 \times 5}{7 \times 8} = \frac{\cancel{2} \times 5}{7 \times \cancel{2} \times 4} = \frac{5}{7 \times 4} = \frac{5}{28}$.

4. $\frac{3}{4}$ of $\frac{7}{8} = \frac{3 \times 7}{4 \times 8} = \frac{21}{32}$.

5. $\frac{2}{3}$ of $\frac{3}{4}$ of $2 = \frac{2 \times \cancel{3} \times 2}{\cancel{3} \times 4} = \frac{\cancel{2} \times \cancel{2}}{\cancel{2} \times \cancel{2}} = 1$.

6. $\frac{2}{5}$ of $\frac{9}{10}$ of $25 = \frac{2 \times 9 \times 25}{5 \times 10} = \frac{\cancel{2} \times 9 \times \cancel{5} \times \cancel{5}}{\cancel{5} \times \cancel{2} \times \cancel{5}} = \frac{9}{1} = 9$.

7. $\frac{2}{3}$ of $\frac{11}{12}$ of $\frac{18}{22} = \frac{2 \times 11 \times 18}{3 \times 12 \times 22} = \frac{\cancel{2} \times \cancel{11} \times \cancel{3} \times \cancel{6}}{\cancel{3} \times \cancel{2} \times \cancel{6} \times 2 \times \cancel{11}} = \frac{1}{2}$.

8. $\frac{7}{8}$ of 9 of $1\frac{1}{3} = \frac{7}{8}$ of $\frac{9}{1}$ of $\frac{4}{3} = \frac{7 \times 9 \times 4}{8 \times 3} = \frac{7 \times \cancel{9} \times 3 \times \cancel{4}}{\cancel{4} \times 2 \times \cancel{8}}$

$= \frac{7 \times 3}{2} = \frac{21}{2}$.

9. $\frac{7}{8}$ of $7\frac{1}{7}$ of $\frac{16}{49} = \frac{7}{8}$ of $\frac{22}{7}$ of $\frac{16}{49} = \frac{7 \times 22 \times 16}{8 \times 7 \times 49}$

$= \frac{\cancel{7} \times 11 \times 2 \times \cancel{8} \times 2}{\cancel{8} \times 3 \times \cancel{7} \times 7} = \frac{11 \times 2 \times 2}{3 \times 7} = \frac{44}{21}$.

10. $2\frac{2}{7}$ of $13\frac{3}{5}$ of $7\frac{7}{10} = \frac{20}{7}$ of $\frac{68}{5}$ of $\frac{77}{10} = \frac{20 \times 68 \times 77}{7 \times 5 \times 10}$.

$= \frac{\cancel{10} \times 2 \times 68 \times \cancel{7} \times 11}{\cancel{7} \times 5 \times \cancel{10}} = \frac{2 \times 68 \times 11}{5} = \frac{1496}{5}$.

11. $\frac{17}{35}$ of $\frac{27}{68}$ of $29\frac{7}{8}$ of $75 = \frac{17}{35}$ of $\frac{27}{68}$ of $\frac{239}{8}$ of 75

$= \frac{17 \times 27 \times 239 \times 75}{35 \times 68 \times 8} = \frac{\cancel{17} \times 27 \times 239 \times \cancel{5} \times 15}{\cancel{5} \times 7 \times 4 \times \cancel{17} \times 8} = \frac{96795}{224}$.

12. $\frac{35}{111}$ of 3 of $5\frac{3}{7}$ of $2\frac{11}{61}$ of $\frac{1}{1000}$

$= \frac{35}{111}$ of 3 of $\frac{37}{7}$ of $\frac{141}{65}$ of $\frac{1}{1000}$

$= \frac{35 \times 3 \times 37 \times 141 \times 1}{111 \times 7 \times 65 \times 1000} = \frac{\cancel{5} \times \cancel{7} \times \cancel{3} \times \cancel{37} \times 141 \times 1}{\cancel{3} \times \cancel{37} \times \cancel{7} \times \cancel{5} \times 13 \times 1000}$

$= \frac{141}{13 \times 1000} = \frac{141}{13000}$.

Ex. IX. Page 19.

In each of the following Examples we divide numerator and denominator by their G. C. M.

Thus in 1. $\frac{5}{10} = \frac{5}{5 \times 2} = \frac{1}{2}$ (dividing by 5, the G. C. M.); or, as we shall write it in the following Examples,

$$\frac{5}{10} = \frac{5 \div 5}{10 \div 5} = \frac{1}{2}.$$

2. $\frac{12}{15}=\frac{12\div3}{15\div3}=\frac{4}{5}$.

3. $\frac{27}{36}=\frac{27\div9}{36\div9}=\frac{3}{4}$.

4. $\frac{56}{63}=\frac{56\div7}{63\div7}=\frac{8}{9}$.

5. $\frac{108}{120}=\frac{108\div12}{120\div12}=\frac{9}{10}$.

6. $\frac{24}{104}=\frac{24\div8}{104\div8}=\frac{3}{13}$.

7. $\frac{84}{228}=\frac{84\div12}{228\div12}=\frac{7}{19}$.

8. $\frac{66}{100}=\frac{66\div2}{100\div2}=\frac{33}{50}$.

9. $\frac{741}{969}=\frac{741\div57}{969\div57}=\frac{13}{17}$.

10. $\frac{374}{561}=\frac{374\div187}{561\div187}=\frac{2}{3}$.

11. $\frac{319}{407}=\frac{319\div11}{407\div11}=\frac{29}{37}$.

12. $\frac{856}{936}=\frac{856\div8}{936\div8}=\frac{107}{117}$.

13. $\frac{1729}{5850}=\frac{1729\div13}{5850\div13}=\frac{133}{450}$.

14. $\frac{176}{1000}=\frac{176\div8}{1000\div8}=\frac{22}{125}$.

15. $\frac{2023}{7581}=\frac{2023\div7}{7581\div7}=\frac{289}{1083}$.

16. $\frac{5544}{6552}=\frac{5544\div504}{6552\div504}=\frac{11}{13}$.

17. $\frac{10395}{16819}=\frac{10395\div11}{16819\div11}=\frac{945}{1529}$.

18. $\frac{80934}{110331}=\frac{80934\div123}{110331\div123}=\frac{658}{897}$.

19. $\frac{1242}{2323}=\frac{1242\div23}{2323\div23}=\frac{54}{101}$.

20. $\frac{13536}{23148}=\frac{13536\div36}{23148\div36}=\frac{376}{643}$.

Ex. X. Page 21.

1. $\frac{2}{9}$, $\frac{7}{15}$. 45 is L. C. M. of denominators;

∴ fractions become $\frac{2\times5}{9\times5}$, $\frac{7\times3}{15\times3}$, or $\frac{10}{45}$, $\frac{21}{45}$.

2. $\frac{1}{3}, \frac{5}{18}$. 18 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{1\times6}{3\times6}, \frac{5}{18}$, or $\frac{6}{18}, \frac{5}{18}$.

3. $\frac{3}{7}, \frac{4}{11}$. 77 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{3\times11}{7\times11}, \frac{4\times7}{11\times7}$, or $\frac{33}{77}, \frac{28}{77}$.

4. $\frac{5}{6}, \frac{8}{9}$. 18 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{5\times3}{6\times3}, \frac{8\times2}{9\times2}$, or $\frac{15}{18}, \frac{16}{18}$.

5. $\frac{7}{12}, \frac{27}{28}$. 84 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{5\times7}{12\times7}, \frac{27\times3}{28\times3}$, or $\frac{49}{84}, \frac{81}{84}$.

6. $\frac{5}{42}, \frac{7}{75}$. 1050 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{5\times25}{42\times25}, \frac{7\times14}{75\times14}$, or $\frac{125}{1050}, \frac{98}{1050}$.

7. $\frac{3}{8}, \frac{5}{9}, \frac{7}{10}$. 360 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{3\times45}{8\times45}, \frac{5\times40}{9\times40}, \frac{7\times36}{10\times36}, \text{ or } \frac{135}{360}, \frac{200}{360}, \frac{252}{360}.$$

8. $\frac{5}{7}, \frac{7}{12}, \frac{13}{15}$. 420 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{5\times60}{7\times60}, \frac{7\times35}{12\times35}, \frac{13\times28}{15\times28}, \text{ or } \frac{300}{420}, \frac{245}{420}, \frac{364}{420}.$$

9. $\frac{2}{15}, \frac{9}{20}, \frac{7}{120}$. 120 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{2\times 8}{15\times 8}, \frac{9\times 6}{20\times 6}, \frac{7}{120}, \text{ or } \frac{16}{120}, \frac{54}{120}, \frac{7}{120}.$$

10. $\frac{17}{18}, \frac{9}{15}, \frac{59}{60}$. 180 is L.C.M. of denominators;

$\therefore$ fractions become

$$\frac{17\times 10}{18\times 10}, \frac{9\times 12}{15\times 12}, \frac{59\times 3}{60\times 3}, \text{ or } \frac{170}{180}, \frac{108}{180}, \frac{177}{180}.$$

11. $\frac{7}{10}, \frac{7}{1000}, \frac{7}{10000}$. 10000 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{7\times 1000}{10\times 1000}, \frac{7\times 10}{1000\times 10}, \frac{7}{10000}, \text{ or } \frac{7000}{10000}, \frac{70}{10000}, \frac{7}{10000}.$$

12. $\frac{31}{60}, \frac{13}{90}, \frac{7}{25}, \frac{4}{105}$. 6300 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{31\times 105}{60\times 105}, \frac{13\times 70}{90\times 70}, \frac{7\times 252}{25\times 252}, \frac{4\times 60}{105\times 60},$$

$$\text{or } \frac{3255}{6300}, \frac{910}{6300}, \frac{1764}{6300}, \frac{240}{6300}.$$

13. $\frac{3}{8}, \frac{14}{15}, \frac{2}{5}, \frac{9}{22}$. 1320 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{3\times 165}{8\times 165}, \frac{14\times 88}{15\times 88}, \frac{2\times 264}{5\times 264}, \frac{9\times 60}{22\times 60},$$

$$\text{or } \frac{495}{1320}, \frac{1232}{1320}, \frac{528}{1320}, \frac{540}{1320}.$$

14. $\frac{4}{9}, \frac{40}{99}, \frac{400}{999}, \frac{4000}{9999}$. 1109889 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{4\times123321}{9\times123321}, \frac{40\times11211}{99\times11211}, \frac{400\times1111}{999\times1111}, \frac{4000\times111}{9999\times111},$$

$$\text{or } \frac{493284}{1109889}, \frac{448440}{1109889}, \frac{444400}{1109889}, \frac{444000}{1109889}.$$

15. $\frac{81}{90}, \frac{65}{180}, \frac{49}{60}, \frac{95}{270}$. 540 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{81\times6}{90\times6}, \frac{65\times3}{180\times3}, \frac{49\times9}{60\times9}, \frac{95\times2}{270\times2},$$

$$\text{or } \frac{486}{540}, \frac{195}{540}, \frac{441}{540}, \frac{190}{540}.$$

16. $\frac{2}{3}, \frac{1}{11}, \frac{1}{21}, \frac{12}{91}, \frac{9}{143}$. 3003 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{2\times1001}{3\times1001}, \frac{1\times273}{11\times273}, \frac{1\times143}{21\times143}, \frac{12\times33}{91\times33}, \frac{9\times21}{143\times21},$$

$$\text{or } \frac{2002}{3003}, \frac{273}{3003}, \frac{143}{3003}, \frac{396}{3003}, \frac{189}{3003}.$$

Ex. XI. Page 22.

1. (1) $\frac{2}{5}, \frac{5}{6}, \frac{7}{12}$. 60 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{2\times12}{5\times12}, \frac{5\times10}{6\times10}, \frac{7\times5}{12\times5}, \text{ or } \frac{24}{60}, \frac{50}{60}, \frac{35}{60};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{5}{6}, \frac{7}{12}, \frac{2}{5}.$$

(2) $\frac{5}{8}, \frac{7}{9}, \frac{23}{24}$. 72 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{5\times 9}{8\times 9}, \frac{7\times 8}{9\times 8}, \frac{23\times 3}{24\times 3}, \text{ or } \frac{45}{72}, \frac{56}{72}, \frac{69}{72};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{23}{24}, \frac{7}{9}, \frac{5}{8}.$$

(3) $\frac{3}{7}, \frac{11}{16}, \frac{23}{36}, \frac{35}{48}$. 1008 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{3\times 144}{7\times 144}, \frac{11\times 63}{16\times 63}, \frac{23\times 28}{36\times 28}, \frac{35\times 21}{48\times 21},$$

$$\text{or } \frac{432}{1008}, \frac{693}{1008}, \frac{644}{1008}, \frac{735}{1008};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{35}{48}, \frac{11}{16}, \frac{23}{36}, \frac{3}{7}.$$

(4) $\frac{2}{9}, \frac{7}{16}, \frac{11}{24}, \frac{17}{36}$. 144 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{2\times 16}{9\times 16}, \frac{7\times 9}{16\times 9}, \frac{11\times 6}{24\times 6}, \frac{17\times 4}{36\times 4},$$

$$\text{or } \frac{32}{144}, \frac{63}{144}, \frac{66}{144}, \frac{68}{144};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{17}{36}, \frac{11}{24}, \frac{7}{16}, \frac{2}{9}.$$

(5) $\frac{4}{7}$ of $\frac{1}{8}$ of $1\frac{1}{3}$, $\frac{5}{8}$ of $\frac{2}{9}$ of $1\frac{1}{5}$ of $\frac{7}{10}$, $\frac{16}{25}$ of $\frac{20}{32}$,

or $\frac{5}{42}, \frac{7}{60}, \frac{2}{5}$. 420 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{5\times10}{42\times10},\ \frac{7\times7}{60\times7},\ \frac{2\times84}{5\times84},\ \text{or}\ \frac{50}{420},\ \frac{49}{420},\ \frac{168}{420};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{16}{25}\ \text{of}\ \frac{20}{32},\ \frac{4}{7}\ \text{of}\ \frac{1}{8}\ \text{of}\ 1\tfrac{1}{4},\ \frac{5}{8}\ \text{of}\ \frac{2}{9}\ \text{of}\ 1\tfrac{1}{5}\ \text{of}\ \frac{7}{20}.$$

(6) $\frac{4}{5}$ of $\frac{6}{8}$ of $\frac{7}{9}$, $12\frac{1}{2}$ of $5\frac{1}{6}$ of $\frac{1}{128}$, $\frac{17}{35}$,

or $\frac{7}{15}$, $\frac{31}{60}$, $\frac{17}{35}$. 420 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{7\times28}{15\times28},\ \frac{31\times7}{60\times7},\ \frac{17\times12}{35\times12},\ \text{or}\ \frac{196}{420},\ \frac{217}{420},\ \frac{204}{420};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$12\tfrac{1}{2}\ \text{of}\ 5\tfrac{1}{6}\ \text{of}\ \frac{1}{128},\ \frac{17}{35},\ \frac{4}{5}\ \text{of}\ \frac{6}{8}\ \text{of}\ \frac{7}{9}.$$

(7) $\frac{14}{15}$, $\frac{18}{20}$, $\frac{19}{21}$, $\frac{24}{25}$, $\frac{29}{30}$. 200 is L. C. M. of den^{s};

$\therefore$ fractions become

$$\frac{14\times140}{15\times140},\ \frac{18\times105}{20\times105},\ \frac{19\times100}{21\times100},\ \frac{24\times84}{25\times84},\ \frac{29\times70}{30\times70},$$

$$\text{or}\ \frac{1960}{2100},\ \frac{1890}{2100},\ \frac{1900}{2100},\ \frac{2016}{2100},\ \frac{2030}{2100};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{29}{30},\ \frac{24}{25},\ \frac{14}{15},\ \frac{19}{21},\ \frac{18}{20}.$$

(8) $\frac{17}{20}$, $\frac{47}{50}$, $\frac{71}{80}$, $\frac{900}{1000}$, $\frac{7777}{100000}$.

100000 is L. C. M. of denominators.

$\therefore$ fractions become

$$\frac{17\times5000}{20\times5000},\ \frac{47\times2000}{50\times2000},\ \frac{71\times1250}{80\times1250},\ \frac{900\times100}{1000\times100},\ \frac{7777}{100000},$$

or $\frac{85000}{100000}, \frac{94000}{100000}, \frac{88750}{100000}, \frac{90000}{100000}, \frac{7777}{100000}$;

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{47}{50}, \frac{900}{1000}, \frac{71}{80}, \frac{17}{20}, \frac{7777}{100000}.$$

(9) $\frac{2}{3}$ of $\frac{1}{4}$ of $3\frac{1}{2}$, $\frac{3}{11}$ of $1\frac{2}{7}$ of $5\frac{1}{3}$ of $\frac{1}{4}, \frac{13}{18}$,

or $\frac{7}{12}, \frac{4}{9}, \frac{13}{18}$. 36 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{7\times3}{12\times3}, \frac{4\times4}{9\times4}, \frac{13\times2}{18\times2}, \text{ or } \frac{21}{36}, \frac{16}{36}, \frac{26}{36};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{13}{18}, \frac{2}{3} \text{ of } \frac{1}{4} \text{ of } 3\frac{1}{2}, \frac{3}{11} \text{ of } 1\frac{2}{7} \text{ of } 5\frac{1}{3} \text{ of } \frac{1}{4}.$$

(10) $\frac{11\times4}{5\times9}, \frac{12\times3}{4\times10}, \frac{10\times5}{6\times8}, \frac{11+4}{5+9}$,

or $\frac{44}{45}, \frac{9}{10}, \frac{25}{24}, \frac{15}{14}$. 2520 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{44\times56}{45\times56}, \frac{9\times252}{10\times252}, \frac{25\times105}{24\times105}, \frac{15\times180}{14\times180},$$

$$\text{or } \frac{2464}{2520}, \frac{2268}{2520}, \frac{2625}{2520}, \frac{2700}{2520};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{11+4}{5+9}, \frac{10\times5}{6\times8}, \frac{11\times4}{5\times9}, \frac{12\times3}{4\times10}.$$

2. (1) $\frac{3}{8}, \frac{7}{16}, \frac{10}{12}, \frac{11}{30}$. 240 is L. C. M. of denominators;

$\therefore$ the fractions become $\frac{3\times30}{8\times30}, \frac{7\times15}{16\times15}, \frac{10\times20}{12\times20}, \frac{11\times8}{30\times8}$,

or $\frac{90}{240}, \frac{105}{240}, \frac{200}{240}, \frac{88}{240}$;

$\therefore \frac{10}{12}$ is the greatest, and $\frac{11}{30}$ the least.

(2) $\frac{4}{5}, \frac{5}{6}, \frac{4+5}{5+6}$, or $\frac{4}{5}, \frac{5}{6}, \frac{9}{11}$.

330 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{4\times66}{5\times66}, \frac{5\times55}{6\times55}, \frac{9\times30}{11\times30}$,

or $\frac{264}{330}, \frac{275}{330}, \frac{270}{330}$;

$\therefore \frac{5}{6}$ is the greatest, and $\frac{4}{5}$ the least.

ADDITION OF VULGAR FRACTIONS.

Ex. XXI. Page 25.

1. (1) $\frac{3}{4}+\frac{5}{8}=\frac{3\times2}{4\times2}+\frac{5}{8}=\frac{6}{8}+\frac{5}{8}=\frac{11}{8}=1\frac{3}{8}$;

$\frac{1}{3}+\frac{5}{12}=\frac{1\times4}{3\times4}+\frac{5}{12}=\frac{4}{12}+\frac{5}{12}=\frac{9}{12}=\frac{3}{4}$;

$\frac{3}{4}+\frac{5}{6}=\frac{3\times3}{4\times3}+\frac{5\times2}{6\times2}=\frac{9}{12}+\frac{10}{12}=\frac{19}{12}=1\frac{7}{12}$;

$\frac{1}{18}+\frac{2}{63}=\frac{1\times7}{18\times7}+\frac{2\times2}{63\times2}=\frac{7}{126}+\frac{4}{126}=\frac{11}{126}$.

(2) $\frac{3}{8}+\frac{1}{2}+\frac{2}{3}=\frac{3\times3}{8\times3}+\frac{1\times12}{2\times12}+\frac{2\times8}{3\times8}$

$=\frac{9}{24}+\frac{12}{24}+\frac{16}{24}=\frac{37}{24}=1\frac{13}{24}$;

$$\frac{3}{4}+\frac{2}{9}+\frac{5}{6}=\frac{3\times9}{4\times9}+\frac{2\times4}{9\times4}+\frac{5\times6}{6\times6}=\frac{27}{36}+\frac{8}{36}+\frac{30}{36}$$

$$=\frac{65}{36}=1\tfrac{29}{36};$$

$$\frac{9}{10}+\frac{5}{7}+\frac{4}{9}=\frac{9\times63}{10\times63}+\frac{5\times90}{7\times90}+\frac{4\times70}{9\times70}$$

$$=\frac{567}{630}+\frac{450}{630}+\frac{280}{630}=\frac{1297}{630}=2\tfrac{37}{630}.$$

(3) $$\frac{5}{6}+\frac{9}{10}+\frac{14}{15}=\frac{5\times10}{6\times10}+\frac{9\times6}{10\times6}+\frac{14\times4}{15\times4}=\frac{50}{60}+\frac{54}{60}+\frac{56}{60}$$

$$=\frac{160}{60}=2\tfrac{2}{3};$$

$$\frac{3}{5}+\frac{35}{80}+\frac{14}{200}=\frac{3\times80}{5\times80}+\frac{35\times5}{80\times5}+\frac{14\times2}{200\times2}$$

$$=\frac{240}{400}+\frac{175}{400}+\frac{28}{400}=\frac{443}{400}=1\tfrac{43}{400};$$

$$\frac{2}{3}+\frac{5}{36}+\frac{7}{720}=\frac{2\times240}{3\times240}+\frac{5\times20}{36\times20}+\frac{7}{720}$$

$$=\frac{480}{720}+\frac{100}{720}+\frac{7}{720}=\frac{587}{720}.$$

(4) $$\frac{3}{5}+\frac{6}{7}+\frac{7}{12}+\frac{19}{28}=\frac{3\times84}{5\times84}+\frac{6\times60}{7\times60}+\frac{7\times35}{12\times35}+\frac{19\times15}{28\times15}$$

$$=\frac{252}{420}+\frac{360}{420}+\frac{245}{420}+\frac{285}{420}$$

$$=\frac{1142}{420}=2\tfrac{151}{210};$$

$$\frac{7}{11}+\frac{7}{16}+\frac{5}{22}+\frac{9}{24}=\frac{7}{11}+\frac{7}{16}+\frac{5}{22}+\frac{3}{8}$$

$$=\frac{7\times16}{11\times16}+\frac{7\times11}{16\times11}+\frac{5\times8}{22\times8}+\frac{3\times22}{8\times22}$$

$$=\frac{112}{176}+\frac{77}{176}+\frac{40}{176}+\frac{66}{176}$$

$$=\frac{295}{176}=1\tfrac{119}{176}.$$

(5) $\frac{1}{3}+\frac{7}{8}+\frac{5}{6}+\frac{9}{14}+\frac{3}{28}+\frac{17}{32}$

$=\frac{1\times224}{3\times224}+\frac{7\times84}{8\times84}+\frac{5\times112}{6\times112}+\frac{9\times48}{14\times48}+\frac{3\times24}{28\times24}+\frac{17\times21}{32\times21}$

$=\frac{224}{672}+\frac{588}{672}+\frac{560}{672}+\frac{432}{672}+\frac{72}{672}+\frac{357}{672}$

$=\frac{2233}{672}=3\frac{217}{672}$;

$\frac{31}{54}+\frac{11}{28}+\frac{53}{63}+\frac{3}{12}=\frac{31\times14}{54\times14}+\frac{11\times27}{28\times27}+\frac{53\times12}{63\times12}+\frac{3\times63}{12\times63}$

$=\frac{434+297+636+189}{756}$

$=\frac{1556}{756}=2\frac{11}{189}$.

(6) $1\frac{1}{8}+\frac{5}{18}+\frac{1}{6}+2\frac{1}{12}=1+2+\frac{3}{8}+\frac{5}{18}+\frac{1}{6}+\frac{1}{12}$

$=3+\frac{3\times9}{8\times9}+\frac{5\times4}{18\times4}+\frac{1\times12}{6\times12}+\frac{1\times6}{12\times6}$

$=3+\frac{27}{72}+\frac{20}{72}+\frac{12}{72}+\frac{6}{72}$

$=3+\frac{65}{72}=3\frac{65}{72}$;

$7\frac{1}{8}+\frac{2}{8}+\frac{7}{12}+2\frac{5}{24}=7+2+\frac{1}{8}+\frac{2}{8}+\frac{7}{12}+\frac{5}{24}$

$=9+\frac{1}{8}+\frac{2}{8}+\frac{7}{12}+\frac{5}{24}$

$=9+\frac{1\times6}{8\times6}+\frac{2\times16}{8\times16}+\frac{7\times4}{12\times4}+\frac{5\times2}{24\times2}$

$=9+\frac{6}{48}+\frac{32}{48}+\frac{28}{48}+\frac{10}{48}$

$=9+\frac{76}{48}=9+1\frac{28}{48}=10\frac{7}{12}$.

(7) $9\frac{1}{7}+1\frac{3}{4}+2\frac{8}{21}+4\frac{13}{24}=9+1+2+4+\frac{1}{7}+\frac{3}{5}+\frac{2}{21}+\frac{13}{24}\cdots$

$$=16+\frac{1\times24}{7\times24}+\frac{3\times42}{4\times42}+\frac{2\times8}{21\times8}+\frac{13\times7}{24\times7}$$

$$=16+\frac{24}{168}+\frac{126}{168}+\frac{16}{168}+\frac{91}{168}$$

$$=16+\frac{257}{168}=16+1\frac{89}{168}$$

$$=17\frac{89}{168};$$

$$\frac{5}{7}+2\frac{2}{9}+\frac{1}{16}+\frac{9}{36}+\frac{75}{63}+\frac{7}{80}$$

$$=\frac{5}{7}+2\frac{2}{9}+\frac{1}{16}+\frac{1}{4}+1\frac{4}{21}+\frac{7}{80}$$

$$=2+1+\frac{5}{7}+\frac{8}{9}+\frac{1}{16}+\frac{1}{4}+\frac{4}{21}+\frac{7}{80}$$

$$=3+\frac{5\times720}{7\times720}+\frac{8\times560}{9\times560}+\frac{1\times315}{16\times315}+\frac{1260}{4\times1260}+\frac{4\times240}{21\times240}+\frac{7\times63}{80\times63}$$

$$=3+\frac{3600}{5040}+\frac{4480}{5040}+\frac{315}{5040}+\frac{1260}{5040}+\frac{960}{5040}+\frac{441}{5040}$$

$$=3+\frac{11056}{5040}=3+2\frac{61}{315}=5\frac{61}{315}.$$

2. (1) $10+\frac{11}{10}+\frac{11}{1000}+\frac{11}{1000000}$

$$=10+\frac{11\times100000}{10\times100000}+\frac{11\times1000}{1000\times1000}+\frac{11}{1000000}$$

$$=10+\frac{1100000+11000+11}{1000000}=10+\frac{1111011}{1000000}$$

$$=10+1\frac{1111011}{1000000}$$

$$=11\frac{1111011}{1000000};$$

$$35\tfrac{1}{8}+\frac{53}{12}+\frac{2}{3}\text{ of }\frac{7}{8}=35\tfrac{1}{8}+4\tfrac{5}{12}+\frac{7}{12}$$

$$=35+4+\frac{1}{8}+\frac{5}{12}+\frac{7}{12}$$

$$=39+\frac{1}{8}+\frac{12}{12}$$

$$=40+\frac{1}{8}=40\tfrac{1}{8}.$$

(2) $\frac{18}{17}\text{ of }5\tfrac{1}{3}\text{ of }\frac{1}{27}+\frac{8}{11}\text{ of }\frac{1}{6}\text{ of }\left(\frac{1}{2}+\frac{5}{12}\right)$

$$=\frac{18}{17}\text{ of }\frac{17}{3}\text{ of }\frac{1}{27}+\frac{8}{11}\text{ of }\frac{1}{6}\text{ of }\frac{11}{12}$$

$$=\frac{2}{9}+\frac{1}{9}=\frac{3}{9}=\frac{1}{3};$$

$$2\tfrac{3}{4}+\left(\frac{3}{5}\text{ of }7\tfrac{1}{2}\right)+7=2\tfrac{3}{4}+\frac{9}{2}+7=2\tfrac{3}{4}+4\tfrac{1}{2}+7$$

$$=2+4+7+\frac{3}{4}+\frac{1}{2}$$

$$=13+\frac{5}{4}=13+1\tfrac{1}{4}=14\tfrac{1}{4}.$$

(3) $\frac{4}{5}\text{ of }\frac{1}{10}+\frac{3}{70}\text{ of }\left(\frac{2}{7}+\frac{4}{5}\right)+\frac{1}{7}\text{ of }\frac{5}{7}+\frac{3}{5}\text{ of }\left(\frac{1}{2}+\frac{11}{12}\right)$

$$=\frac{2}{25}+\frac{3}{70}\text{ of }\frac{38}{35}+\frac{5}{49}+\frac{3}{5}\text{ of }\frac{17}{12}$$

$$=\frac{2}{25}+\frac{57}{35\times35}+\frac{5}{49}+\frac{17}{20}$$

$$=\frac{2\times196+57\times4+5\times100+17\times245}{4900}$$

$$=\frac{392+228+500+4165}{4900}$$

$$=\frac{5285}{4900}=1\tfrac{11}{140}.$$

3. He sells in all $\left(2\frac{2}{3}+3\frac{3}{4}+4\frac{4}{5}+5\frac{5}{6}+6\frac{6}{7}+\frac{13}{140}\right)$ lbs.

$$=\left(20+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\frac{5}{6}+\frac{6}{7}+\frac{13}{140}\right)\text{ lbs.}$$

$$=\left(20+\frac{2\times140+3\times105+4\times84+5\times70+6\times60+13\times3}{420}\right)\text{ lbs.}$$

$$=\left(20+\frac{280+315+336+350+360+39}{420}\right)\text{ lbs.}$$

$$=\left(20+\frac{1680}{420}\right)\text{ lbs.}=(20+4)\text{ lbs.}=24\text{ lbs.}$$

4. Fraction $=\frac{2}{3}+\frac{5}{7}=\frac{14+15}{21}=\frac{29}{21}=1\frac{8}{21}$.

5. No. of gals. through $A=1\frac{1}{2}$ of $3\frac{1}{3}$ of $24=\frac{4}{3}$ of $\frac{16}{5}$ of 24

$$=\frac{512}{5}=102\tfrac{2}{5},$$

..... $B=1\frac{7}{12}$ of $1\frac{1}{5}$ of $39=\frac{19}{12}$ of $\frac{6}{5}$ of 39

$$=\frac{741}{10}=74\tfrac{1}{10},$$

..... $C=3\frac{1}{2}$ of $\frac{1}{7}$ of $5\frac{1}{3}$ of 44

$$=\frac{7}{2}\text{ of }\frac{1}{7}\text{ of }\frac{16}{3}\text{ of }44=\frac{352}{3}=117\tfrac{1}{3};$$

$\therefore$ cask contained $(102\frac{2}{5}+74\frac{1}{10}+117\frac{1}{3})$ gals.

$$=\left(293+\frac{2}{5}+\frac{1}{10}+\frac{1}{3}\right)\text{ gals.}$$

$$=\left(293+\frac{12+3+10}{30}\right)\text{ gals.}$$

$$=293\tfrac{5}{6}\text{ gals.}$$

SUBTRACTION OF VULGAR FRACTIONS.

Ex. XIII. Page 28.

1. (1) $\frac{5}{6}-\frac{3}{4}=\frac{5\times2}{6\times2}-\frac{3\times3}{4\times3}=\frac{10}{12}-\frac{9}{12}=\frac{1}{12}$;

$\frac{9}{10}-\frac{7}{8}=\frac{9\times4}{10\times4}-\frac{7\times5}{8\times5}=\frac{36}{40}-\frac{35}{40}=\frac{1}{40}$;

$\frac{16}{20}-\frac{2}{5}=\frac{16}{20}-\frac{2\times4}{5\times4}=\frac{16}{20}-\frac{8}{20}=\frac{8}{20}=\frac{2}{5}$.

(2) $\frac{2}{7}-\frac{2}{11}=\frac{2\times11}{7\times11}-\frac{2\times7}{11\times7}=\frac{22}{77}-\frac{14}{77}=\frac{8}{77}$;

$6-\frac{41}{7}=\frac{6\times7}{1\times7}-\frac{41}{7}=\frac{42}{7}-\frac{41}{7}=\frac{1}{7}$;

$9-5\frac{1}{3}=\frac{9\times3}{1\times3}-\frac{16}{3}=\frac{27}{3}-\frac{16}{3}=\frac{11}{3}=3\frac{2}{3}$.

(3) $13\frac{3}{8}-7\frac{1}{4}=(13-7)+\left(\frac{5}{8}-\frac{1\times2}{4\times2}\right)=6+\frac{3}{8}=6\frac{3}{8}$;

$16\frac{1}{2}-9\frac{3}{7}=(16-9)+\left(\frac{1}{2}-\frac{3}{7}\right)=7+\left(\frac{1\times7}{14}-\frac{3\times2}{14}\right)$

$=7+\frac{1}{14}=7\frac{1}{14}$;

$7\frac{3}{8}-5\frac{3}{7}=(7-5)+\left(\frac{2}{8}-\frac{3}{7}\right)=2+\left(\frac{2\times7-3\times3}{21}\right)=2\frac{5}{21}$.

(4) $4\frac{5}{8}-\frac{17}{9}=\frac{37}{8}-\frac{17}{9}=\frac{37\times9}{8\times9}-\frac{17\times8}{9\times8}=\frac{333-136}{72}$

$=\frac{197}{72}=2\frac{53}{72}$;

$27\frac{19}{20}-6\frac{9}{10}=(27-6)+\left(\frac{19}{20}-\frac{9}{10}\right)=21+\left(\frac{19}{20}-\frac{18}{20}\right)$

$=21\frac{1}{20}$;

$16\frac{1}{4}-9\frac{3}{8}=(15-9)+\left(\frac{5}{4}-\frac{3}{8}\right)=6+\left(\frac{10}{8}-\frac{3}{8}\right)=6\frac{7}{8}$.

(5) $\frac{2}{3}$ of $\frac{3}{4}=\frac{1}{2}$, $\frac{1}{2}$ of $\frac{2}{6}=\frac{1}{6}$, $\frac{1}{2}-\frac{1}{6}=\frac{3}{6}-\frac{1}{6}=\frac{2}{6}=\frac{1}{3}$;

$\frac{6}{8}$ of $24=\frac{6}{8}$ of $\frac{24}{1}=6\times3=18$,

$\frac{6}{9}$ of $27=\frac{6}{9}$ of $\frac{27}{1}=6\times3=18$, $18-18=0$.

(6) $9\frac{3}{16}=\frac{147}{16}$, $7\frac{5}{12}$ of $1\frac{1}{4}=\frac{89}{12}$ of $\frac{5}{4}=\frac{445}{48}$,

$\frac{445}{48}-\frac{147}{16}=\frac{445}{48}-\frac{441}{48}=\frac{4}{48}=\frac{1}{12}$;

$\frac{1}{4}$ of $\left(2+\frac{1}{5}\right)=\frac{1}{4}$ of $\frac{11}{5}=\frac{11}{20}$,

$\frac{3}{20}$ of $(2\frac{1}{2}+3\frac{1}{2})=\frac{3}{20}$ of $5\frac{5}{6}=\frac{3}{20}$ of $\frac{35}{6}=\frac{7}{8}$,

$\frac{7}{8}-\frac{11}{20}=\frac{35}{40}-\frac{22}{40}=\frac{13}{40}$.

2. Number required $=1\frac{13}{40}-\frac{3}{5}=\frac{59}{40}-\frac{24}{40}=\frac{35}{40}=\frac{7}{8}$;

$$\text{Number req}^{\text{d}}.=20-\left(1\tfrac{7}{11}+2\tfrac{7}{16}+3\tfrac{5}{22}+\frac{9}{24}\right)$$

$$=20-\left(6+\frac{7}{11}+\frac{7}{16}+\frac{5}{22}+\frac{3}{8}\right)$$

$$=20-\left(6+\frac{7\times16}{11\times16}+\frac{7\times11}{16\times11}+\frac{5\times8}{22\times8}+\frac{3\times22}{8\times22}\right)$$

$$=20-\left(6+\frac{112+77+40+66}{176}\right)$$

$$=20-\left(6+\frac{295}{176}\right)$$

$$=20-7\tfrac{119}{176}$$

$$=12\tfrac{57}{176}.$$

3. Sum of $3\frac{1}{3}$ and $2\frac{5}{6} = 5 + \left(\frac{1}{3} + \frac{5}{6}\right) = 5 + \frac{7}{6} = 6\frac{1}{6}$;

difference of $3\frac{1}{3}$ and $2\frac{5}{6} = (2-2) + \left(\frac{4}{3} - \frac{5}{6}\right) = \frac{3}{6}$;

$$\therefore \text{ Ans.} = 6\tfrac{1}{6} - \frac{3}{6} = \frac{37}{6} - \frac{3}{6} = \frac{34}{6} = 5\tfrac{4}{6}.$$

4. After giving away $\frac{1}{2}$ of orange, representing the orange by unity or 1, $\frac{1}{2}$ remained;

$\therefore$ he gave away altogether $\left(\frac{1}{2} + \frac{1}{3} \text{ of } \frac{1}{2}\right)$ of $1 = \left(\frac{1}{2} + \frac{1}{6}\right)$

$$= \left(\frac{3}{6} + \frac{1}{6}\right) = \frac{4}{6} = \frac{2}{3};$$

$\therefore$ he kept for himself $1 - \frac{2}{3} = \frac{1}{3}$ of orange.

5. Amount of error $= \frac{15}{30} - \frac{15}{31} = \frac{465 - 450}{930} = \frac{15}{930} = \frac{1}{62}$.

6. I pay away $\frac{1}{3}$ of my money, representing the money by unity or 1;

$$\therefore 1 - \frac{1}{3} \text{ or } \frac{2}{3} \text{ of money remains;}$$

I then pay away $\frac{1}{4}$ of $\frac{2}{3}$ or $\frac{1}{6}$ of my money,

$$\therefore \frac{2}{3} - \frac{1}{6} \text{ or } \frac{3}{6} \text{ or } \frac{1}{2} \text{ of money remains;}$$

I then pay away $\frac{1}{5}$ of $\frac{1}{2}$ or $\frac{1}{10}$ of my money,

$$\therefore \frac{1}{2} - \frac{1}{10} \text{ or } \frac{4}{10} \text{ or } \frac{2}{5} \text{ remains.}$$

7. *A* receives $\frac{3}{5}$ of cake, *B* receives $\frac{2}{3}$ of $\frac{3}{5}$ or $\frac{2}{5}$,

$$\therefore A \text{ has left } \frac{3}{5} - \frac{2}{5} \text{ or } \frac{1}{5};$$

C receives $\frac{3}{4}$ of $\frac{2}{5}$ or $\frac{3}{10}$, $\therefore B$ has left $\frac{2}{5} - \frac{3}{10} = \frac{4}{10} - \frac{3}{10} = \frac{1}{10}$;

$$\therefore A \text{ has } \frac{1}{5} \text{ left, } B \frac{1}{10}, \text{ and } C \text{ has } \frac{3}{10}.$$

Also *C* has $\frac{3}{10} - \frac{1}{5} = \frac{3}{10} - \frac{2}{10} = \frac{1}{10}$ more than *A*.

8. 1st woman will have travelled at 11.30 A.M. $= 7\frac{1}{2}$ miles,
2nd ..... $= 5$ .....;

$\therefore$ they are distant from each other $2\frac{1}{2}$ miles, or five half-miles, at 11.30 A.M.

whole distance $= 24$ half-miles;

$$\therefore \text{Ans.} = \frac{5}{24}.$$

MULTIPLICATION OF VULGAR FRACTIONS.

Ex. XIV. Page 31.

1. (1) $\frac{3}{6} \times \frac{3}{9} = \frac{\cancel{3} \times \cancel{3}}{\cancel{6} \times 2 \times \cancel{3} \times 3} = \frac{1}{6}$;

$$\frac{8}{12} \times 6 = \frac{\cancel{4} \times \cancel{2} \times \cancel{6}}{\cancel{6} \times \cancel{2}} = 4;$$

$$35 \times \frac{5}{7} = \frac{5 \times \cancel{7} \times 5}{\cancel{7}} = 25;$$

$$15\tfrac{3}{4} \times 7 = \frac{63 \times 7}{4} = \frac{441}{4} = 110\tfrac{1}{4}.$$

(2) $16\frac{2}{3} \times \frac{4}{6}$ of $6 = \frac{50}{3} \times \frac{4}{5} \times \frac{6}{1} = \frac{\cancel{5} \times 10 \times \cancel{4} \times 2 \times \cancel{3}}{\cancel{3} \times \cancel{5}} = 80$;

$\frac{5}{9}$ of $\frac{8}{12} \times \frac{6}{7} = \frac{5 \times \cancel{4} \times 2 \times \cancel{3}}{\cancel{3} \times 3 \times \cancel{4} \times 3 \times 7} = \frac{20}{63}$;

$2\frac{1}{3}$ of $3\frac{1}{2} \times \left(1 - \frac{17}{32}\right) = \frac{7}{3} \times \frac{16}{5} \times \frac{15}{32}$

$= \frac{7 \times \cancel{16} \times \cancel{5} \times \cancel{3}}{\cancel{3} \times \cancel{5} \times \cancel{16} \times 2} = \frac{7}{2} = 3\frac{1}{2}$.

(3) $\frac{3}{18}$ of $\frac{60}{81}$ of $\frac{78}{55} \times \frac{11}{12} = \frac{3 \times \cancel{12} \times \cancel{5} \times \cancel{13} \times 6 \times \cancel{11}}{\cancel{18} \times 9 \times 9 \times \cancel{5} \times \cancel{11} \times \cancel{12}}$

$= \frac{3 \times 6}{9 \times 9}$

$\frac{\cancel{3} \times \cancel{3} \times 2}{\cancel{3} \times \cancel{3} \times 3 \times 3} = \frac{2}{9}$;

$\frac{8}{15}$ of $\frac{65}{72}$ of $\frac{42}{105}$ of $\frac{81}{96} \times 6\frac{2}{11} = \frac{8}{15} \times \frac{65}{72} \times \frac{42}{105} \times \frac{81}{96} \times \frac{80}{13}$

$= \frac{\cancel{8} \times \cancel{5} \times \cancel{13} \times 6 \times 7 \times \cancel{9} \times 9 \times 10 \times \cancel{8}}{\cancel{5} \times 3 \times \cancel{8} \times \cancel{9} \times 5 \times 21 \times \cancel{8} \times 12 \times \cancel{13}} = \frac{6 \times 7 \times 9 \times 10}{3 \times 5 \times 21 \times 12}$

$= \frac{2 \times \cancel{3} \times \cancel{7} \times \cancel{3} \times \cancel{3} \times 2 \times \cancel{5}}{\cancel{3} \times \cancel{5} \times \cancel{3} \times \cancel{7} \times \cancel{3} \times 4} = \frac{2 \times 2}{4} = 1$;

$(16\frac{5}{8} - 3\frac{1}{4}) = (16 - 3) + \left(\frac{5}{8} - \frac{2}{8}\right) = 13\frac{3}{8}$;

$16\frac{5}{8} - 3\frac{1}{4}) \times 3\frac{1}{3} = 13\frac{3}{8} \times 3\frac{1}{3} = \frac{107}{8} \times \frac{16}{5}$

$= \frac{107 \times 2}{5} = \frac{214}{5} = 42\frac{4}{5}$.

(4) $\left(4 - \frac{3}{5}\right)$ of $\frac{11}{26} \times \frac{4}{11}$ of $\left(1 - \frac{4}{5}\right)$ of 10

$= \frac{17}{5}$ of $\frac{11}{26} \times \frac{4}{11}$ of $\frac{1}{5}$ of 10

$= \frac{17 \times \cancel{11} \times 4 \times 10}{5 \times 26 \times \cancel{11} \times 5} = \frac{17 \times 4 \times \cancel{2} \times \cancel{5}}{\cancel{5} \times \cancel{2} \times 13 \times 5}$

$= \frac{68}{65} = 1\frac{3}{65}$;

$$\frac{5}{18} \text{ of } 2\tfrac{1}{4} \text{ of } 3\tfrac{6}{10} \times 2\tfrac{1}{4} \text{ of } \frac{3}{10} \text{ of } 2 \text{ of } \frac{8}{27}$$

$$= \frac{5}{18} \text{ of } \frac{7}{3} \text{ of } \frac{18}{5} \times \frac{9}{4} \text{ of } \frac{3}{10} \text{ of } 2 \text{ of } \frac{8}{27}$$

$$= \frac{\cancel{5} \times 7 \times \cancel{18} \times 9 \times \cancel{3} \times 2 \times 8}{\cancel{18} \times \cancel{3} \times \cancel{5} \times 4 \times 10 \times 27} = \frac{7 \times \cancel{9} \times \cancel{2} \times 2 \times \cancel{4}}{\cancel{4} \times \cancel{2} \times 5 \times \cancel{9} \times 3} = \frac{14}{15}.$$

(5) $\frac{5}{7}$ of $\frac{6}{13}$ of $\frac{11}{15}$ of $\frac{1}{2}$ of $29 \times \left(1 - \frac{9}{35}\right)$ of $\frac{6}{10}$ of $\frac{3}{11}$ of $4\frac{106}{261}$

$$= \frac{5}{7} \text{ of } \frac{6}{13} \text{ of } \frac{11}{15} \text{ of } \frac{1}{2} \text{ of } \frac{29}{1} \text{ of } \frac{26}{35} \text{ of } \frac{3}{5} \text{ of } \frac{3}{11} \text{ of } \frac{1250}{261}$$

$$= \frac{\cancel{5} \times 6 \times \cancel{11} \times 29 \times 26 \times 3 \times 3 \times 1250}{7 \times 13 \times 15 \times 2 \times 35 \times \cancel{5} \times \cancel{11} \times 261}$$

$$= \frac{\cancel{2} \times \cancel{3} \times \cancel{29} \times 2 \times \cancel{13} \times \cancel{3} \times \cancel{3} \times \cancel{5} \times \cancel{5} \times 5 \times 5 \times 2}{7 \times \cancel{13} \times \cancel{5} \times \cancel{3} \times \cancel{3} \times \cancel{5} \times 7 \times \cancel{3} \times \cancel{3} \times \cancel{29}}$$

$$= \frac{2 \times 5 \times 5 \times 2}{7 \times 7} = \frac{100}{49} = 2\tfrac{2}{49}.$$

2. Difference $= 15\frac{1}{5} - \frac{1}{5} \times 15$

$= 15\frac{1}{5} - 3 = 12\frac{1}{5}$.

3. 1st fraction $= 2\frac{1}{3} + 5\frac{1}{2} = 7\frac{5}{6}$,

2nd ..... $= 5\frac{1}{2} - 2\frac{1}{3} = 3\frac{1}{6}$;

sum of these fractions $= 7\frac{5}{6} + 3\frac{1}{6} = 11$,

product ..... $= \frac{47}{6} \times \frac{19}{6} = \frac{893}{36} = 24\frac{29}{36}$;

$\therefore$ Ans. $= 24\frac{29}{36} - 11 = 13\frac{29}{36}$.

4. In one hour 1st man digs $\frac{1}{7}$ of $\frac{5}{9}$ or $\frac{5}{63}$ of piece of work,

..... 2nd ..... $\frac{3}{4}$ of $\frac{5}{63}$ or $\frac{5}{84}$ .....

$\therefore$ ..... both men can dig $\frac{5}{63} + \frac{5}{84}$ or $\frac{35}{252}$ .....

$\therefore$ in 4 hours both men can dig $\frac{35\times4}{252}$ or $\frac{35}{63}$ or $\frac{5}{9}$ of piece of work;

$$\therefore \text{Ans.} = \frac{5}{9}-\frac{1}{2}=\frac{10-9}{18}=\frac{1}{18}.$$

DIVISION OF VULGAR FRACTIONS.

Ex. XV. Page 33.

1. (1) $\frac{2}{3}\div\frac{3}{5}=\frac{2}{3}\times\frac{5}{3}=\frac{2\times5}{3\times3}=\frac{10}{9}=1\frac{1}{9}$;

$$\frac{9}{10}\div\frac{3}{4}=\frac{9}{10}\times\frac{4}{3}=\frac{\cancel{9}^{3}\times3\times\cancel{2}^{1}\times2}{\cancel{2}^{1}\times5\times\cancel{3}^{1}}=\frac{6}{5}=1\tfrac{1}{5};$$

$$\frac{9}{10}\div6=\frac{9}{10}\times\frac{1}{6}=\frac{\cancel{3}^{1}\times3}{10\times\cancel{3}^{1}\times2}=\frac{3}{20};$$

$$6\div\frac{9}{10}=\frac{6}{1}\times\frac{10}{9}=\frac{2\times\cancel{3}^{1}\times10}{\cancel{3}^{1}\times3}=\frac{20}{3}=6\tfrac{2}{3}.$$

(2) $\frac{4}{3}\div\frac{5}{6}=\frac{4}{3}\times\frac{6}{5}=\frac{4\times2\times\cancel{3}^{1}}{\cancel{3}^{1}\times5}=\frac{8}{5}=1\frac{3}{5}$;

$$\frac{41}{33}\div\frac{63}{11}=\frac{41}{33}\times\frac{11}{63}=\frac{41\times\cancel{11}^{1}}{3\times\cancel{11}^{1}\times63}=\frac{41}{189};$$

$$\frac{6}{7}\div\frac{2}{9}=\frac{6}{7}\times\frac{9}{2}=\frac{\cancel{2}^{1}\times3\times9}{7\times\cancel{2}^{1}}=\frac{27}{7}=3\tfrac{6}{7};$$

$$\div11=\frac{22}{17}\times\frac{1}{11}=\frac{2\times11}{17\times11}=\frac{2}{17}.$$

$$\frac{\cancel{3}^{1}\times8\times2}{\times\cancel{3}^{1}\times5\times13}=\frac{16}{325};$$

$$\frac{4}{7} \text{ of } 16 \div \frac{2}{3} \text{ of } \frac{4}{5} = \frac{4 \times 16}{7} \times \frac{3 \times 5}{2 \times 4}$$

$$= \frac{\cancel{4} \times \cancel{2} \times 8 \times 3 \times 5}{7 \times \cancel{2} \times \cancel{4}} = \frac{120}{7} = 17\tfrac{1}{7};$$

$$\frac{2}{3} \text{ of } 1\tfrac{2}{5} \div 48 = \frac{2}{3} \times \frac{8}{5} \times \frac{1}{48} = \frac{\cancel{2} \times \cancel{8}}{3 \times 5 \times \cancel{2} \times \cancel{8} \times 3} = \frac{1}{45}.$$

(4) $\frac{23}{24}$ of $\frac{31}{60}$ of $31\frac{1}{2} \div \frac{22}{62}$ of $\frac{31}{24}$ of 31

$$= \frac{23}{\cancel{2}\cancel{4}} \times \frac{31}{60} \times \frac{63}{2} \times \frac{\cancel{62}}{22} \times \frac{\cancel{2}\cancel{4}}{\cancel{31}} \times \frac{1}{31}$$

$$= \frac{23 \times \cancel{3}\cancel{1} \times 7 \times \cancel{3} \times 3 \times \cancel{2} \times \cancel{3}\cancel{1}}{\cancel{3} \times 20 \times \cancel{2} \times 22 \times \cancel{3}\cancel{1} \times \cancel{3}\cancel{1}}$$

$$= \frac{23 \times 7 \times 3}{20 \times 22} = \frac{483}{440} = 1\tfrac{43}{440};$$

$$18 \div \frac{5}{12} \text{ of } \frac{8}{9} \text{ of } \frac{4}{5} \text{ of } \frac{14}{25} \text{ of } 1\tfrac{4}{11}$$

$$= \frac{18}{1} \times \frac{12}{5} \times \frac{9}{8} \times \frac{5}{4} \times \frac{25}{14} \times \frac{11}{15}$$

$$= \frac{\cancel{2} \times 9 \times \cancel{4} \times \cancel{3} \times 9 \times \cancel{5} \times \cancel{5} \times 5 \times 11}{\cancel{5} \times \cancel{2} \times \cancel{4} \times 4 \times 14 \times \cancel{5} \times \cancel{3}}$$

$$= \frac{9 \times 9 \times 5 \times 11}{4 \times 14} = \frac{4455}{56} = 79\tfrac{31}{56}.$$

2. (1) $\dfrac{3\frac{1}{3}}{6} = \dfrac{\frac{10}{3}}{\frac{6}{1}} = \frac{10}{3} \times \frac{1}{6} = \frac{2 \times 5}{3 \times 3 \times 2} = \frac{5}{9}$;

$$\frac{6}{3\frac{1}{3}} = \frac{\frac{6}{1}}{\frac{10}{3}} = \frac{6}{1} \times \frac{3}{10} = \frac{2 \times 3 \times 3}{2 \times 5} = \frac{9}{5} = 1\tfrac{4}{5};$$

$$\frac{\frac{1}{3}}{5\frac{3}{4}} = \frac{\frac{1}{3}}{\frac{23}{4}} = \frac{1}{3} \times \frac{4}{23} = \frac{4}{69};$$

$$\frac{13\frac{7}{8}}{19\frac{5}{6}} = \frac{\frac{111}{8}}{\frac{119}{6}} = \frac{111}{8} \times \frac{6}{119} = \frac{111 \times \cancel{6}^{3} \times 3}{\cancel{8}_{4} \times 4 \times 119} = \frac{333}{476};$$

$$\frac{\frac{8}{9} \times \frac{3}{4} \text{ of } \frac{2}{7}}{\frac{5}{7}} = \frac{8}{9} \times \frac{3}{4} \times \frac{2}{7} \times \frac{7}{5} = \frac{2 \times \cancel{4}_{1} \times \cancel{8}^{2} \times 2 \times \cancel{7}}{\cancel{8}_{3} \times 9 \times \cancel{4}_{1} \times \cancel{7}_{1} \times 5}$$

$$= \frac{4}{15};$$

$$\frac{\frac{2}{3} \text{ of } \frac{6\frac{1}{7}}{9\frac{3}{4}}}{\frac{4}{7} \text{ of } \frac{2\frac{1}{2}}{9}} = \frac{\frac{2}{3} \text{ of } \frac{\frac{43}{7}}{\frac{28}{3}}}{\frac{4}{7} \text{ of } \frac{\frac{7}{3}}{9}} = \frac{\frac{2}{3} \text{ of } \frac{43}{7} \times \frac{3}{28}}{\frac{4}{7} \text{ of } \frac{7}{3} \times \frac{1}{9}}$$

$$= \frac{2 \times 43 \times \cancel{3}^{1}}{\cancel{3}_{1} \times 7 \times 28} \times \frac{\cancel{7}^{1} \times 3 \times 9}{4 \times \cancel{7}_{1} \times 1}$$

$$= \frac{\cancel{2}^{1} \times 43 \times 3 \times 9}{7 \times \cancel{2}_{1} \times 14 \times 4} = 2\frac{411}{392}.$$

(2) $$\frac{\frac{1}{3} - \frac{1}{4}}{\frac{1}{3} + \frac{1}{4}} = \frac{\frac{4-3}{12}}{\frac{4+3}{12}} = \frac{\frac{1}{12}}{\frac{7}{12}} = \frac{1 \times 12}{12 \times 7} = \frac{1}{7};$$

$$\frac{\frac{5}{7} - \frac{13}{49}}{\frac{1}{3} - \frac{1}{11}} = \frac{\frac{35-13}{49}}{\frac{11-3}{33}} = \frac{\frac{22}{49}}{\frac{8}{33}} = \frac{22 \times 33}{49 \times 8} = \frac{\cancel{2}^{1} \times 11 \times 33}{49 \times \cancel{2}_{1} \times 4}$$

$$= \frac{363}{196} = 1\frac{167}{196};$$

$$\frac{8\frac{1}{2}-3\frac{1}{2}}{\frac{1}{2\frac{1}{2}}+\frac{1}{1\frac{1}{3}}}=\frac{\frac{41}{5}-\frac{13}{4}}{\frac{1}{\frac{5}{2}}+\frac{1}{\frac{4}{3}}}=\frac{\frac{41}{5}-\frac{13}{4}}{\frac{2}{5}+\frac{3}{4}}$$

$$=\frac{\frac{164-65}{20}}{\frac{8+15}{20}}=\frac{\frac{99}{20}}{\frac{23}{20}}$$

$$=\frac{99\times 20}{20\times 23}=\frac{99}{23}=4\tfrac{7}{23};$$

$$\frac{6\frac{1}{7}-2\frac{1}{2}}{5\frac{2}{3}+4\frac{1}{2}}\div\frac{4\frac{1}{3}+\frac{1}{7}}{5\frac{1}{7}-1\frac{1}{3}}=\frac{4\frac{3}{56}}{9\frac{5}{6}}\div\frac{4\frac{10}{21}}{3\frac{17}{21}}$$

$$=\frac{\frac{225}{56}}{\frac{41}{4}}\div\frac{\frac{94}{21}}{\frac{80}{21}}=\frac{225}{56}\times\frac{4}{41}\div\left(\frac{94}{21}\times\frac{21}{80}\right)$$

$$=\frac{225\times 4\times 80}{56\times 41\times 94}=\frac{225\times\cancel{2}\times 2\times\cancel{8}\times 10}{7\times\cancel{8}\times 41\times\cancel{2}\times 47}$$

$$=\frac{4500}{13489}.$$

(3) $$3+\frac{1}{7+\frac{1}{16}}=3+\frac{1}{\frac{7\times 16+1}{16}}=3+\frac{1}{\frac{113}{16}}$$

$$=3+\frac{16}{113}=3\tfrac{16}{113};$$

$$\frac{1}{2+\frac{1}{3+\frac{1}{4}}}=\frac{1}{2+\frac{1}{\frac{12+1}{4}}}=\frac{1}{2+\frac{4}{13}}$$

$$=\frac{1}{\frac{2\times 13+4}{13}}=\frac{13}{30};$$

$$2\tfrac{1}{2} \times \frac{1}{3\frac{1}{3} + \frac{1}{4\frac{1}{4}}} = \frac{5}{2} \times \frac{1}{\frac{10}{3} + \frac{1}{\frac{17}{4}}}$$

$$= \frac{5}{2} \times \frac{1}{\frac{10}{3} + \frac{4}{17}} = \frac{5}{2} \times \frac{1}{\frac{170+12}{51}}$$

$$= \frac{5}{2} \times \frac{51}{182} = \frac{255}{364}.$$

3. (1) $\text{Ans.} = 35 \div 10\frac{5}{6} = \frac{35}{1} \times \frac{6}{65} = \frac{\cancel{5} \times 7 \times 6}{\cancel{5} \times 13} = \frac{42}{13} = 3\frac{3}{13}$.

(2) $$\text{Ans.} = \left(\frac{1}{12} + \frac{1}{4} + \frac{1}{8}\right) \div \left(\frac{1}{3} + \frac{1}{6} + \frac{1}{9}\right)$$

$$= \left(\frac{2+6+3}{24}\right) \div \left(\frac{6+3+2}{18}\right)$$

$$= \frac{11}{24} \div \frac{11}{18} = \frac{11}{24} \times \frac{18}{11} = \frac{\cancel{6} \times 3}{\cancel{6} \times 4} = \frac{3}{4}.$$

4. Sum of $7\frac{1}{3}$ and $7\frac{1}{4} = 14\frac{7}{12}$,

difference..... $= \frac{1}{12}$;

$\therefore$ product $= 14\frac{7}{12} \times \frac{1}{12} = \frac{175}{12} \times \frac{1}{12}$;

$\therefore$ number required $= \frac{175}{12 \times 12} \div 254 = \frac{175}{12 \times 12 \times 254}$

$$= \frac{175}{36576}.$$

5. 35 st. $3\frac{1}{2}$ lbs. $= (493\frac{1}{2})$ lbs.;

$\therefore$ No. of parcels $= 493\frac{1}{2} \div 5\frac{7}{8}$

$$= \frac{987}{2} \times \frac{8}{47} = \frac{\cancel{47} \times 21 \times \cancel{2} \times 4}{\cancel{2} \times \cancel{47}}$$

$$= 84.$$

REDUCTION OF VULGAR FRACTIONS.

Ex. XVI. Page 38.

1. (1) $\frac{5}{8}$ of £1 $= \left(\frac{5 \times 20}{8}\right) s. = \frac{25}{2} s. = 12s.\ 6d.$

$\frac{3}{5}$ of £1 $= \left(\frac{3 \times 20}{5}\right) s. = 12s.$

$\frac{3}{4}$ of £1 $= \left(\frac{3 \times 20}{4}\right) s. = 15s.$

$\frac{7}{12}$ of $1s. = \left(\frac{7 \times 12}{12}\right) d. = 7d.$

(2) $\frac{7}{12}$ of £1 $= \left(\frac{7 \times 20}{12}\right) s. = \left(\frac{7 \times 5}{3}\right) s. = 11s.\ 8d.$

$\frac{25}{32}$ of £1 $= \left(\frac{25 \times 20}{32}\right) s. = \left(\frac{25 \times 5}{8}\right) s. = \frac{125}{8} s. = 15s.\ 7\frac{1}{2}d.$

$\frac{2}{3}$ of $10s. = \left(\frac{2 \times 10}{3}\right) s. = \frac{20}{3} s. = 6s.\ 8d.$

$\frac{7}{25}$ of £5 $= \left(\frac{7 \times 5}{25}\right) £ = \frac{7}{5} £ = £1.\ 8s.$

(3) $\frac{13}{15}$ of $2s.\ 6d. = \left(\frac{13 \times 30}{15}\right) d. = (13 \times 2)d. = 2s.\ 2d.$

$\frac{37}{40}$ of $5s. = \left(\frac{37 \times 5}{40}\right) s. = \frac{37}{8} s. = 4s.\ 7\frac{1}{2}d.$

$\frac{61}{84}$ of $10s.\ 6d. = \left(\frac{61 \times 126}{84}\right) d. = \left(\frac{61 \times 3}{2}\right) d.$

$= \frac{183}{2} d. = 7s.\ 7\frac{1}{2}d.$

$\left(\frac{35}{1296} \text{ of } 27\right) s. = \left(\frac{35 \times 27}{1296}\right) s. = \frac{35}{48} s. = \left(\frac{35 \times 12}{48}\right) d.$

$= \frac{35}{4} d. = 8\frac{3}{4}d.$

(4) $\frac{7}{8}$ cwt. $= \left(\frac{7 \times 4}{8}\right)$ qrs. $= \frac{7}{2}$ qrs. $= 3$ qrs. 14 lbs.

$\frac{341}{720}$ lbs. Troy $= \left(\frac{341 \times 12}{720}\right)$ oz. $= \frac{341}{60}$ oz. $= 5$ oz. $+ \frac{41}{60}$ oz.

$= 5$ oz. $+ \frac{41 \times 20}{60}$ dwts. $= 5$ oz. $+ \frac{41}{3}$ dwts.

$= 5$ oz. 13 dwts. 16 grs.

$\frac{59}{64}$ ac. $= \left(\frac{59}{64} \times 4\right)$ ro. $= \frac{59}{16}$ ro. $= 3$ ro. $+ \frac{11}{16}$ ro.

$= 3$ ro. $+ \frac{11 \times 40}{16}$ po. $= 3$ ro. $+ \frac{110}{4}$ po.

$= 3$ ro. 27 po. $+ \frac{1}{2}$ po.;

and $\frac{1}{2}$ po. $= \frac{30\frac{1}{4}}{2}$ sq. yds. $= 15\frac{1}{8}$ sq. yds. $= 15$ sq. yds. $+ \frac{9}{8}$ sq. ft.

$= 15$ sq. yds. $1\frac{1}{8}$ sq. ft. $= 15$ sq. yds. 1 sq. ft. 18 sq. in.

$\therefore \frac{59}{64}$ ac. $= 3$ ro. 27 po. 15 sq. yds. 1 sq. ft. 18 sq. in.

(5) $\frac{3}{8}$ of £1. 7*s*. 6*d*. $= \frac{£4.\ 2s.\ 6d.}{8} = 10s.\ 3\frac{3}{4}d.$;

$2\frac{1}{4}$ of £1. 12*s*. 8*d*. $= (£1.\ 12s.\ 8d.) \times 2 + \frac{1}{4}$ of £1. 12*s*. 8*d*.

$= £3.\ 5s.\ 4d. + 8s.\ 2d. = £3.\ 13s.\ 6d.$;

$\frac{199}{324}$ of 2 cub. yds. $= \frac{398}{324}$ cub. yds. $= 1$ cub. yd. $+ \frac{37}{162}$ cub. yds.

$\frac{37}{162}$ cub. yds. $= \left(\frac{37 \times 27}{162}\right)$ cub. ft. $= \frac{37}{6}$ cub. ft.

$= 6$ cub. ft. 288 cub. in.;

$\therefore \frac{199}{324}$ of 2 cub. yds. $= 1$ cub. yd. 6 cub. ft. 288 cub. in.

(6) $2\frac{1}{4}$ of $\frac{1}{2}$ a mile $= \frac{11}{8}$ m. $= 1$ m. $+ \frac{3}{8}$ m. $= 1$ m. $+ \frac{3 \times 1760}{8}$ yds.

$= 1$ m. 660 yds.;

$\frac{3}{7}$ of $1\frac{3}{4}$ of 2 ro. 35 po. $= \frac{3}{7}$ of $\frac{7}{5}$ of 115 po. $= (3 \times 23)$ po.

$= 69$ po. $= 1$ ro. 29 po.;

$\frac{5}{16}$ of 5 hrs. 25 min. 40 sec. $= \left(\frac{5}{16} \text{ of } 19540\right)$ sec.

$= \frac{5 \times 4885}{4}$ sec. $= \frac{24425}{4}$ sec. $= 6106\frac{1}{4}$ sec.

$= 1$ hr. 41 min. $46\frac{1}{4}$ sec.

2. (1) $\frac{3}{8}$ of $1s. = \left(\frac{3 \times 12}{8}\right)d.$

		s.	d.
$\frac{3}{8}$ of $1s. = \left(\frac{3 \times 12}{8}\right)d.$	=	0	$4\frac{1}{2}$
$\frac{7}{8}$ of $21s. = \frac{147}{8}s.$	=	18	$4\frac{1}{2}$
$\frac{2}{5}$ of $2s.\ 6d. = \frac{5}{2}s.$	=	1	0
		19	9
$\frac{3}{4}$ of $20s. = \frac{60}{4}s.$	=	15	0
$\therefore$ value required $=$		4	9

(2) $\frac{7}{8}$ of £5. 10*s*. 6*d*. $= \frac{£38.\ 13s.\ 6d.}{8} =$

£	s.	d.
4	16	$8\frac{1}{4}$

$1\frac{3}{5}$ of $1\frac{1}{2}$ guins. $= \left(\frac{5}{3} \text{ of } \frac{3}{2}\right)$ guins.

$= \left(\frac{5}{3} \text{ of } \frac{3}{2} \text{ of } 21\right)s. =$

	2	12	6
	7	9	$2\frac{1}{2}$
$\frac{4}{7}$ of 2 guineas $= \left(\frac{4 \times 42}{7}\right)s.$ =	1	4	0
$\therefore$ value required $=$	6	5	$2\frac{1}{2}$

(2) $16\frac{2}{3} \times \frac{4}{6}$ of $6 = \frac{50}{3} \times \frac{4}{5} \times \frac{6}{1} = \frac{\cancel{5} \times 10 \times 4 \times 2 \times \cancel{3}}{\cancel{3} \times \cancel{5}} = 80$;

$\frac{5}{9}$ of $\frac{8}{12} \times \frac{6}{7} = \frac{5 \times \cancel{4} \times 2 \times 2 \times \cancel{3}}{\cancel{3} \times 3 \times \cancel{4} \times 3 \times 7} = \frac{20}{63}$;

$2\frac{1}{3}$ of $3\frac{1}{7} \times \left(1 - \frac{17}{32}\right) = \frac{7}{3} \times \frac{16}{5} \times \frac{15}{32}$

$= \frac{7 \times \cancel{16} \times \cancel{5} \times \cancel{3}}{\cancel{3} \times \cancel{5} \times \cancel{16} \times 2} = \frac{7}{2} = 3\frac{1}{2}$.

(3) $\frac{3}{18}$ of $\frac{60}{81}$ of $\frac{78}{55} \times \frac{11}{12} = \frac{3 \times \cancel{12} \times \cancel{5} \times \cancel{13} \times 6 \times \cancel{11}}{\cancel{12} \times 9 \times 9 \times \cancel{5} \times \cancel{11} \times \cancel{12}}$

$= \frac{3 \times 6}{9 \times 9}$

$\frac{\cancel{3} \times \cancel{3} \times 2}{\cancel{3} \times \cancel{3} \times 3 \times 3} = \frac{2}{9}$;

$\frac{8}{15}$ of $\frac{65}{72}$ of $\frac{42}{105}$ of $\frac{81}{96} \times 6\frac{2}{12} = \frac{8}{15} \times \frac{65}{72} \times \frac{42}{105} \times \frac{81}{96} \times \frac{80}{13}$

$= \frac{\cancel{8} \times \cancel{5} \times \cancel{13} \times 6 \times 7 \times \cancel{9} \times 9 \times 10 \times \cancel{8}}{\cancel{5} \times 3 \times \cancel{8} \times \cancel{9} \times 5 \times 21 \times \cancel{8} \times 12 \times \cancel{13}} = \frac{6 \times 7 \times 9 \times 10}{3 \times 5 \times 21 \times 12}$

$= \frac{2 \times \cancel{3} \times \cancel{7} \times \cancel{3} \times \cancel{3} \times 2 \times \cancel{5}}{\cancel{3} \times \cancel{5} \times \cancel{3} \times \cancel{7} \times \cancel{3} \times 4} = \frac{2 \times 2}{4} = 1$;

$(16\frac{5}{8} - 3\frac{1}{4}) = (16 - 3) + \left(\frac{5}{8} - \frac{2}{8}\right) = 13\frac{3}{8}$;

$16\frac{5}{8} - 3\frac{1}{4}) \times 3\frac{1}{3} = 13\frac{3}{8} \times 3\frac{1}{3} = \frac{107}{8} \times \frac{16}{5}$

$= \frac{107 \times 2}{5} = \frac{214}{5} = 42\frac{4}{5}$.

(4) $\left(4 - \frac{3}{5}\right)$ of $\frac{11}{26} \times \frac{4}{11}$ of $\left(1 - \frac{4}{5}\right)$ of 10

$= \frac{17}{5}$ of $\frac{11}{26} \times \frac{4}{11}$ of $\frac{1}{5}$ of 10

$= \frac{17 \times \cancel{11} \times 4 \times 10}{5 \times 26 \times \cancel{11} \times 5} = \frac{17 \times 4 \times \cancel{2} \times \cancel{5}}{\cancel{5} \times \cancel{2} \times 13 \times 5}$

$= \frac{68}{65} = 1\frac{3}{65}$;

$$\frac{5}{18} \text{ of } 2\tfrac{1}{2} \text{ of } 3\tfrac{6}{10} \times 2\tfrac{1}{4} \text{ of } \frac{3}{10} \text{ of } 2 \text{ of } \frac{8}{27}$$

$$= \frac{5}{18} \text{ of } \frac{7}{3} \text{ of } \frac{18}{5} \times \frac{9}{4} \text{ of } \frac{3}{10} \text{ of } 2 \text{ of } \frac{8}{27}$$

$$= \frac{\cancel{5} \times 7 \times \cancel{18} \times 9 \times \cancel{3} \times 2 \times 8}{\cancel{18} \times \cancel{3} \times \cancel{5} \times 4 \times 10 \times 27} = \frac{7 \times \cancel{9} \times \cancel{2} \times 2 \times \cancel{4}}{\cancel{4} \times \cancel{2} \times 5 \times \cancel{9} \times 3} = \frac{14}{15}.$$

(5) $\frac{5}{7}$ of $\frac{6}{13}$ of $\frac{11}{15}$ of $\frac{1}{2}$ of $29 \times \left(1 - \frac{9}{35}\right)$ of $\frac{6}{10}$ of $\frac{3}{11}$ of $4\frac{106}{261}$

$$= \frac{5}{7} \text{ of } \frac{6}{13} \text{ of } \frac{11}{15} \text{ of } \frac{1}{2} \text{ of } \frac{29}{1} \text{ of } \frac{26}{35} \text{ of } \frac{3}{5} \text{ of } \frac{3}{11} \text{ of } \frac{1250}{261}$$

$$= \frac{\cancel{5} \times 6 \times \cancel{11} \times 29 \times 26 \times 3 \times 3 \times 1250}{7 \times 13 \times 15 \times 2 \times 35 \times \cancel{5} \times \cancel{11} \times 261}$$

$$= \frac{\cancel{2} \times \cancel{3} \times \cancel{29} \times 2 \times \cancel{13} \times \cancel{3} \times \cancel{3} \times \cancel{5} \times \cancel{5} \times 5 \times 5 \times 2}{7 \times \cancel{13} \times \cancel{5} \times \cancel{3} \times \cancel{3} \times \cancel{5} \times 7 \times \cancel{3} \times \cancel{3} \times \cancel{29}}$$

$$= \frac{2 \times 5 \times 5 \times 2}{7 \times 7} = \frac{100}{49} = 2\tfrac{2}{49}.$$

2. Difference $= 15\frac{1}{5} - \frac{1}{5} \times 15$

$$= 15\tfrac{1}{5} - 3 = 12\tfrac{1}{5}.$$

3. 1st fraction $= 2\frac{1}{3} + 5\frac{1}{2} = 7\frac{5}{6}$,
2nd ..... $= 5\frac{1}{2} - 2\frac{1}{3} = 3\frac{1}{6}$;
sum of these fractions $= 7\frac{5}{6} + 3\frac{1}{6} = 11$,
product ..... $= \frac{47}{6} \times \frac{19}{6} = \frac{893}{36} = 24\frac{29}{36}$;

$$\therefore \text{ Ans.} = 24\tfrac{29}{36} - 11 = 13\tfrac{29}{36}.$$

4. In one hour 1st man digs $\frac{1}{7}$ of $\frac{5}{9}$ or $\frac{5}{63}$ of piece of work,
..... 2nd ..... $\frac{3}{4}$ of $\frac{5}{63}$ or $\frac{5}{84}$ .....
$\therefore$ ..... both men can dig $\frac{5}{63} + \frac{5}{84}$ or $\frac{35}{252}$ .....

(2) $16\frac{1}{2} \times \frac{4}{6}$ of $6 = \frac{50}{3} \times \frac{4}{5} \times \frac{6}{1} = \frac{\cancel{5} \times 10 \times \cancel{4} \times 2 \times \cancel{6}}{\cancel{3} \times \cancel{5}} = 80$;

$\frac{5}{9}$ of $\frac{8}{12} \times \frac{6}{7} = \frac{5 \times \cancel{4} \times 2 \times 2 \times \cancel{3}}{\cancel{3} \times 3 \times \cancel{4} \times 3 \times 7} = \frac{20}{63}$;

$2\frac{1}{2}$ of $3\frac{1}{4} \times \left(1 - \frac{17}{32}\right) = \frac{7}{3} \times \frac{16}{5} \times \frac{15}{32}$

$= \frac{7 \times \cancel{16} \times \cancel{5} \times \cancel{3}}{\cancel{3} \times \cancel{5} \times \cancel{16} \times 2} = \frac{7}{2} = 3\frac{1}{2}$.

(3) $\frac{3}{13}$ of $\frac{60}{81}$ of $\frac{78}{55} \times \frac{11}{12} = \frac{3 \times \cancel{12} \times \cancel{5} \times \cancel{13} \times 6 \times \cancel{11}}{\cancel{13} \times 9 \times 9 \times \cancel{5} \times \cancel{11} \times \cancel{12}}$

$= \frac{3 \times 6}{9 \times 9}$

$\frac{\cancel{3} \times \cancel{3} \times 2}{\cancel{3} \times \cancel{3} \times 3 \times 3} = \frac{2}{9}$;

$\frac{8}{15}$ of $\frac{65}{72}$ of $\frac{42}{105}$ of $\frac{81}{96} \times 6\frac{2}{13} = \frac{8}{15} \times \frac{65}{72} \times \frac{42}{105} \times \frac{81}{96} \times \frac{80}{13}$

$= \frac{\cancel{8} \times \cancel{5} \times \cancel{14} \times 6 \times 7 \times \cancel{9} \times 9 \times 10 \times \cancel{8}}{\cancel{5} \times 3 \times \cancel{8} \times \cancel{9} \times 5 \times 21 \times \cancel{8} \times 12 \times \cancel{14}} = \frac{6 \times 7 \times 9 \times 10}{3 \times 5 \times 21 \times 12}$

$= \frac{2 \times \cancel{3} \times \cancel{7} \times \cancel{3} \times \cancel{3} \times 2 \times \cancel{5}}{\cancel{3} \times \cancel{5} \times \cancel{3} \times \cancel{7} \times \cancel{3} \times 4} = \frac{2 \times 2}{4} = 1$;

$(16\frac{5}{8} - 3\frac{1}{4}) = (16 - 3) + \left(\frac{5}{8} - \frac{2}{8}\right) = 13\frac{3}{8}$;

$16\frac{5}{8} - 3\frac{1}{4}) \times 3\frac{1}{5} = 13\frac{3}{8} \times 3\frac{1}{5} = \frac{107}{8} \times \frac{16}{5}$

$= \frac{107 \times 2}{5} = \frac{214}{5} = 42\frac{4}{5}$.

(4) $\left(4 - \frac{3}{5}\right)$ of $\frac{11}{26} \times \frac{4}{11}$ of $\left(1 - \frac{4}{5}\right)$ of 10

$= \frac{17}{5}$ of $\frac{11}{26} \times \frac{4}{11}$ of $\frac{1}{5}$ of 10

$= \frac{17 \times \cancel{11} \times 4 \times 10}{5 \times 26 \times \cancel{11} \times 5} = \frac{17 \times 4 \times \cancel{2} \times \cancel{5}}{\cancel{5} \times \cancel{2} \times 13 \times 5}$

$= \frac{68}{65} = 1\frac{3}{65}$;

$$\frac{5}{18} \text{ of } 2\tfrac{1}{2} \text{ of } 3\tfrac{5}{10} \times 2\tfrac{1}{4} \text{ of } \frac{3}{10} \text{ of } 2 \text{ of } \frac{8}{27}$$

$$= \frac{5}{18} \text{ of } \frac{7}{3} \text{ of } \frac{18}{5} \times \frac{9}{4} \text{ of } \frac{3}{10} \text{ of } 2 \text{ of } \frac{8}{27}$$

$$= \frac{\cancel{5} \times 7 \times \cancel{18} \times \cancel{9} \times \cancel{3} \times 2 \times 8}{\cancel{18} \times \cancel{3} \times \cancel{5} \times 4 \times 10 \times 27} = \frac{7 \times \cancel{9} \times \cancel{2} \times 2 \times \cancel{4}}{\cancel{4} \times \cancel{2} \times 5 \times \cancel{9} \times 3} = \frac{14}{15}.$$

(5) $\frac{5}{7}$ of $\frac{6}{13}$ of $\frac{11}{15}$ of $\frac{1}{2}$ of $29 \times \left(1 - \frac{9}{35}\right)$ of $\frac{6}{10}$ of $\frac{3}{11}$ of $4\frac{100}{261}$

$$= \frac{5}{7} \text{ of } \frac{6}{13} \text{ of } \frac{11}{15} \text{ of } \frac{1}{2} \text{ of } \frac{29}{1} \text{ of } \frac{26}{35} \text{ of } \frac{3}{5} \text{ of } \frac{3}{11} \text{ of } \frac{1250}{261}$$

$$= \frac{\cancel{5} \times 6 \times \cancel{11} \times 29 \times 26 \times 3 \times 3 \times 1250}{7 \times 13 \times 15 \times 2 \times 35 \times \cancel{5} \times \cancel{11} \times 261}$$

$$= \frac{\cancel{2} \times \cancel{3} \times \cancel{29} \times 2 \times \cancel{13} \times \cancel{3} \times \cancel{3} \times \cancel{5} \times \cancel{5} \times 5 \times 5 \times 2}{7 \times \cancel{13} \times \cancel{5} \times \cancel{3} \times \cancel{3} \times \cancel{5} \times 7 \times \cancel{3} \times \cancel{3} \times \cancel{29}}$$

$$= \frac{2 \times 5 \times 5 \times 2}{7 \times 7} = \frac{100}{49} = 2\tfrac{2}{49}.$$

2. Difference $= 15\frac{1}{5} - \frac{1}{5} \times 15$

$= 15\frac{1}{5} - 3 = 12\frac{1}{5}$.

3. 1st fraction $= 2\frac{1}{2} + 5\frac{1}{2} = 7\frac{5}{6}$,

2nd ..... $= 5\frac{1}{2} - 2\frac{1}{3} = 3\frac{1}{6}$;

sum of these fractions $= 7\frac{5}{6} + 3\frac{1}{6} = 11$,

product ..... $= \frac{47}{6} \times \frac{19}{6} = \frac{893}{36} = 24\frac{29}{36}$;

$\therefore$ Ans. $= 24\frac{29}{36} - 11 = 13\frac{29}{36}$.

4. In one hour 1st man digs $\frac{1}{7}$ of $\frac{5}{9}$ or $\frac{5}{63}$ of piece of work,

..... 2nd ..... $\frac{3}{4}$ of $\frac{5}{63}$ or $\frac{5}{84}$ .....

$\therefore$ ..... both men can dig $\frac{5}{63} + \frac{5}{84}$ or $\frac{35}{252}$ .....

$$\frac{\frac{1}{3}}{5\frac{3}{4}} = \frac{\frac{1}{3}}{\frac{23}{4}} = \frac{1}{3} \times \frac{4}{23} = \frac{4}{69};$$

$$\frac{18\frac{1}{6}}{19\frac{5}{6}} = \frac{\frac{111}{8}}{\frac{119}{6}} = \frac{111}{8} \times \frac{6}{119} = \frac{111 \times \cancel{6}^{3}}{\cancel{8}^{4} \times 4 \times 119} = \frac{333}{476};$$

$$\frac{\frac{8}{9} \times \frac{3}{4} \text{ of } \frac{2}{7}}{\frac{5}{7}} = \frac{8}{9} \times \frac{3}{4} \times \frac{2}{7} \times \frac{7}{5} = \frac{2 \times \cancel{4}^{1} \times \cancel{8}^{2} \times 2 \times \cancel{7}^{1}}{\cancel{8}^{3} \times 3 \times \cancel{4}^{1} \times \cancel{7}^{1} \times 5}$$

$$= \frac{4}{15};$$

$$\frac{\frac{2}{3} \text{ of } \frac{6\frac{1}{2}}{9\frac{1}{3}}}{\frac{4}{7} \text{ of } \frac{2\frac{1}{2}}{9}} = \frac{\frac{2}{3} \text{ of } \frac{\frac{43}{7}}{\frac{28}{3}}}{\frac{4}{7} \text{ of } \frac{7}{9}} = \frac{\frac{2}{3} \text{ of } \frac{43}{7} \times \frac{3}{28}}{\frac{4}{7} \text{ of } \frac{7}{3} \times \frac{1}{9}}$$

$$= \frac{2 \times 43 \times \cancel{3}^{1}}{\cancel{3}^{1} \times 7 \times 28} \times \frac{\cancel{7}^{1} \times 3 \times 9}{4 \times \cancel{7}^{1} \times 1}$$

$$= \frac{\cancel{2}^{1} \times 43 \times 3 \times 9}{7 \times \cancel{2}^{1} \times 14 \times 4} = 2\frac{111}{392}.$$

(2) $$\frac{\frac{1}{3} - \frac{1}{4}}{\frac{1}{3} + \frac{1}{4}} = \frac{\frac{4-3}{12}}{\frac{4+3}{12}} = \frac{\frac{1}{12}}{\frac{7}{12}} = \frac{1 \times 12}{12 \times 7} = \frac{1}{7};$$

$$\frac{\frac{5}{7} - \frac{13}{49}}{\frac{1}{3} - \frac{1}{11}} = \frac{\frac{35-13}{49}}{\frac{11-3}{33}} = \frac{\frac{22}{49}}{\frac{8}{33}} = \frac{22 \times 33}{49 \times 8} = \frac{\cancel{2}^{1} \times 11 \times 33}{49 \times \cancel{2}^{1} \times 4}$$

$$= \frac{363}{196} = 1\frac{167}{196};$$

$$\frac{8\frac{1}{2}-3\frac{1}{4}}{\frac{1}{2\frac{1}{2}}+\frac{1}{1\frac{1}{3}}}=\frac{\frac{41}{5}-\frac{13}{4}}{\frac{1}{\frac{5}{2}}+\frac{1}{\frac{4}{3}}}=\frac{\frac{41}{5}-\frac{13}{4}}{\frac{2}{5}+\frac{3}{4}}$$

$$=\frac{\frac{164-65}{20}}{\frac{8+15}{20}}=\frac{\frac{99}{20}}{\frac{23}{20}}$$

$$=\frac{99\times 20}{20\times 23}=\frac{99}{23}=4\tfrac{7}{23};$$

$$\frac{6\frac{1}{7}-2\frac{1}{8}}{5\frac{3}{4}+4\frac{1}{2}}\div\frac{4\frac{1}{3}+\frac{1}{7}}{5\frac{1}{4}-1\frac{1}{3}}=\frac{4\frac{1}{56}}{9\frac{5}{4}}\div\frac{4\frac{10}{21}}{3\frac{17}{11}}$$

$$=\frac{\frac{225}{56}}{\frac{41}{4}}\div\frac{\frac{94}{21}}{\frac{80}{21}}=\frac{225}{56}\times\frac{4}{41}\div\left(\frac{94}{21}\times\frac{21}{80}\right)$$

$$=\frac{225\times 4\times 80}{56\times 41\times 94}=\frac{225\times\cancel{2}\times 2\times\cancel{8}\times 10}{7\times\cancel{8}\times 41\times\cancel{2}\times 47}$$

$$=\frac{4500}{13489}.$$

(3) $$3+\frac{1}{7+\frac{1}{16}}=3+\frac{1}{\frac{7\times 16+1}{16}}=3+\frac{1}{\frac{113}{16}}$$

$$=3+\frac{16}{113}=3\tfrac{16}{113};$$

$$\frac{1}{2+\frac{1}{3+\frac{1}{4}}}=\frac{1}{2+\frac{1}{\frac{12+1}{4}}}=\frac{1}{2+\frac{4}{13}}$$

$$=\frac{1}{\frac{2\times 13+4}{13}}=\frac{13}{30};$$

$$2\tfrac{1}{2} \times \frac{1}{3\frac{1}{3} + \frac{1}{4\frac{1}{2}}} = \frac{5}{2} \times \frac{1}{\frac{10}{3} + \frac{1}{\frac{17}{4}}}$$

$$= \frac{5}{2} \times \frac{1}{\frac{10}{3} + \frac{4}{17}} = \frac{5}{2} \times \frac{1}{\frac{170+12}{51}}$$

$$= \frac{5}{2} \times \frac{51}{182} = \frac{255}{364}.$$

3. (1) $\text{Ans.} = 35 \div 10\frac{5}{6} = \frac{35}{1} \times \frac{6}{65} = \frac{\cancel{5} \times 7 \times \cancel{6}}{\cancel{5} \times 13} = \frac{42}{13} = 3\frac{3}{13}$.

(2) $$\text{Ans.} = \left(\frac{1}{12} + \frac{1}{4} + \frac{1}{8}\right) \div \left(\frac{1}{3} + \frac{1}{6} + \frac{1}{9}\right)$$

$$= \left(\frac{2+6+3}{24}\right) \div \left(\frac{6+3+2}{18}\right)$$

$$= \frac{11}{24} \div \frac{11}{18} = \frac{11}{24} \times \frac{18}{11} = \frac{\cancel{6} \times 3}{\cancel{6} \times 4} = \frac{3}{4}.$$

4. Sum of $7\frac{1}{3}$ and $7\frac{1}{4} = 14\frac{7}{12}$,

difference..... $= \frac{1}{12}$;

$\therefore$ product $= 14\frac{7}{12} \times \frac{1}{12} = \frac{175}{12} \times \frac{1}{12}$;

$\therefore$ number required $= \frac{175}{12 \times 12} \div 254 = \frac{175}{12 \times 12 \times 254}$

$$= \frac{175}{36576}.$$

5. 35 st. $3\frac{1}{2}$ lbs. $= (493\frac{1}{2})$ lbs.;

$\therefore$ No. of parcels $= 493\frac{1}{2} \div 5\frac{7}{8}$

$$= \frac{987}{2} \times \frac{8}{47} = \frac{\cancel{47} \times 21 \times \cancel{2} \times 4}{\cancel{2} \times \cancel{47}}$$

$$= 84.$$

REDUCTION OF VULGAR FRACTIONS.

Ex. XVI. Page 38.

1. (1) $\frac{5}{8}$ of £1 $= \left(\frac{5 \times 20}{8}\right) s. = \frac{25}{2} s. = 12s.\ 6d.$

$\frac{3}{5}$ of £1 $= \left(\frac{3 \times 20}{5}\right) s. = 12s.$

$\frac{3}{4}$ of £1 $= \left(\frac{3 \times 20}{4}\right) s. = 15s.$

$\frac{7}{12}$ of 1s. $= \left(\frac{7 \times 12}{12}\right) d. = 7d.$

(2) $\frac{7}{12}$ of £1 $= \left(\frac{7 \times 20}{12}\right) s. = \left(\frac{7 \times 5}{3}\right) s. = 11s.\ 8d.$

$\frac{25}{32}$ of £1 $= \left(\frac{25 \times 20}{32}\right) s. = \left(\frac{25 \times 5}{8}\right) s. = \frac{125}{8} s. = 15s.\ 7\frac{1}{2}d.$

$\frac{2}{3}$ of 10s. $= \left(\frac{2 \times 10}{3}\right) s. = \frac{20}{3} s. = 6s.\ 8d.$

$\frac{7}{25}$ of £5 $= \left(\frac{7 \times 5}{25}\right) £ = \frac{7}{5} £ = £1.\ 8s.$

(3) $\frac{13}{15}$ of 2s. 6d. $= \left(\frac{13 \times 30}{15}\right) d. = (13 \times 2) d. = 2s.\ 2d.$

$\frac{37}{40}$ of 5s. $= \left(\frac{37 \times 5}{40}\right) s. = \frac{37}{8} s. = 4s.\ 7\frac{1}{2}d.$

$\frac{61}{84}$ of 10s. 6d. $= \left(\frac{61 \times 126}{84}\right) d. = \left(\frac{61 \times 3}{2}\right) d.$

$= \frac{183}{2} d. = 7s.\ 7\frac{1}{2}d.$

$\left(\frac{35}{1296} \text{ of } 27\right) s. = \left(\frac{35 \times 27}{1296}\right) s. = \frac{35}{48} s. = \left(\frac{35 \times 12}{48}\right) d.$

$= \frac{35}{4} d. = 8\frac{3}{4}d.$

(4) $\frac{7}{8}$ cwt. $= \left(\frac{7 \times 4}{8}\right)$ qrs. $= \frac{7}{2}$ qrs. $= 3$ qrs. 14 lbs.

$\frac{341}{720}$ lbs. Troy $= \left(\frac{341 \times 12}{720}\right)$ oz. $= \frac{341}{60}$ oz. $= 5$ oz. $+ \frac{41}{60}$ oz.

$= 5$ oz. $+ \frac{41 \times 20}{60}$ dwts. $= 5$ oz. $+ \frac{41}{3}$ dwts.

$= 5$ oz. 13 dwts. 16 grs.

$\frac{59}{64}$ ac. $= \left(\frac{59}{64} \times 4\right)$ ro. $= \frac{59}{16}$ ro. $= 3$ ro. $+ \frac{11}{16}$ ro.

$= 3$ ro. $+ \frac{11 \times 40}{16}$ po. $= 3$ ro. $+ \frac{110}{4}$ po.

$= 3$ ro. 27 po. $+ \frac{1}{2}$ po.;

and $\frac{1}{2}$ po. $= \frac{30\frac{1}{4}}{2}$ sq. yds. $= 15\frac{1}{8}$ sq. yds. $= 15$ sq. yds. $+ \frac{9}{8}$ sq. ft.

$= 15$ sq. yds. $1\frac{1}{8}$ sq. ft. $= 15$ sq. yds. 1 sq. ft. 18 sq. in.

$\therefore \frac{59}{64}$ ac. $= 3$ ro. 27 po. 15 sq. yds. 1 sq. ft. 18 sq. in.

(5) $\frac{3}{8}$ of £1. 7*s*. 6*d*. $= \frac{£4.\ 2s.\ 6d.}{8} = 10s.\ 3\frac{3}{4}d.$;

$2\frac{1}{4}$ of £1. 12*s*. 8*d*. $= (£1.\ 12s.\ 8d.) \times 2 + \frac{1}{4}$ of £1. 12*s*. 8*d*.

$= £3.\ 5s.\ 4d. + 8s.\ 2d. = £3.\ 13s.\ 6d.$;

$\frac{199}{324}$ of 2 cub. yds. $= \frac{398}{324}$ cub. yds. $= 1$ cub. yd. $+ \frac{37}{162}$ cub. yds.

$\frac{37}{162}$ cub. yds. $= \left(\frac{37 \times 27}{162}\right)$ cub. ft. $= \frac{37}{6}$ cub. ft.

$= 6$ cub. ft. 288 cub. in.;

$\therefore \frac{199}{324}$ of 2 cub. yds. $= 1$ cub. yd. 6 cub. ft. 288 cub. in.

(6) $2\frac{1}{4}$ of $\frac{1}{2}$ a mile $= \frac{11}{8}$ m. $= 1$ m. $+ \frac{3}{8}$ m. $= 1$ m. $+ \frac{3 \times 1760}{8}$ yds.

$= 1$ m. 660 yds.;

$\frac{3}{7}$ of $1\frac{3}{5}$ of 2 ro. 35 po. $= \frac{3}{7}$ of $\frac{7}{5}$ of 115 po. $= (3 \times 23)$ po.

$= 69$ po. $= 1$ ro. 29 po.;

$\frac{5}{16}$ of 5 hrs. 25 min. 40 sec. $= \left(\frac{5}{16} \text{ of } 19540\right)$ sec.

$= \frac{5 \times 4885}{4}$ sec. $= \frac{24425}{4}$ sec. $= 6106\frac{1}{4}$ sec.

$=1$ hr. 41 min. $46\frac{1}{4}$ sec.

2. (1) $\frac{3}{8}$ of $1s. = \left(\frac{3 \times 12}{8}\right)d. =$ $s.$ 0, $d.$ $4\frac{1}{2}$

$\frac{7}{8}$ of $21s. = \frac{147}{8}s.$ $= 18 \quad 4\frac{1}{2}$

$\frac{2}{5}$ of $2s.\ 6d. = \frac{5}{5}s.$ $= 1 \quad 0$

$19 \quad 9$

$\frac{3}{4}$ of $20s. = \frac{60}{4}s.$ $= 15 \quad 0$

$\therefore$ value required $= 4 \quad 9$

(2) $\frac{7}{8}$ of £5. 10s. 6d. $= \frac{£38.\ 13s.\ 6d.}{8} =$ £ 4, s. 16, d. $8\frac{1}{4}$

$1\frac{2}{3}$ of $1\frac{1}{2}$ guins. $= \left(\frac{5}{3} \text{ of } \frac{3}{2}\right)$ guins.

$= \left(\frac{5}{3} \text{ of } \frac{3}{2} \text{ of } 21\right)s. = 2 \quad 12 \quad 6$

$7 \quad 9 \quad 2\frac{1}{4}$

$\frac{4}{7}$ of 2 guineas $= \left(\frac{4 \times 42}{7}\right)s. \quad = 1 \quad 4 \quad 0$

$\therefore$ value required $= 6 \quad 5 \quad 2\frac{1}{4}$

		£	s.	d.
(3)	$\left(\frac{1}{2}+\frac{3}{4}\right)$£. = 10s. + 15s. =	1	5	0
	$\left(\frac{1}{3}+\frac{3}{5}\right)$s. = 4d. + $7\frac{1}{5}$d. =	0	0	$11\frac{1}{5}$
	$\left(\frac{1}{4}+\frac{4}{5}\right)$d. =	0	0	$0\frac{11}{20}$
	∴ value required =	1	5	$11\frac{31}{20}$
	= £1. 6s. $0\frac{11}{20}$d.			

		ac.	ro.	po.	yds.
(4)	$1\frac{3}{8}$ of $2\frac{1}{2}$ ac. = $\left(\frac{5}{8}$ of $\frac{5}{2}\right)$ ac. =	4	0	26	$20\frac{1}{8}$
	$\frac{5}{8}$ ro. = $\left(\frac{5\times40}{8}\right)$ po. =	0	0	25	0
	$\frac{4}{11}$ of $4\frac{1}{3}$ po. = $\left(\frac{4\times13}{11\times3}\right)$ po. =	0	0	1	$17\frac{5}{11}$
	∴ value required =	4	1	12	$37\frac{7}{11}$
	= 4 ac. 1 ro. 13 po. $7\frac{7}{11}$ yds.				

		wks.	d.	hrs.	m.
(5)	$\frac{7}{8}$ of a common year = $\frac{7\times365}{8}$ d. =	45	4	9	0
	$\frac{8}{9}$ d. = $\left(\frac{8\times24}{9}\right)$ hrs. =			21	20
		45	5	6	20
	$\frac{2}{3}$ wk. = $\left(\frac{2\times7}{3}\right)$ d. =		4	16	0
	∴ value required =	45	0	14	20

3. (1)

£	s.	d.	
3	18	6	
		10	
39	5	0	for 10
		10	
392	10	0	for 10 × 10 or 100
		7	
2747	10	0	for 100 × 7 or 700
196	5	0	for 10 × 5 or 50
23	11	0	for 6
2967	6	0	for 756
3	5	5	for $\frac{5}{8}$
2970	11	5	for $756\frac{5}{8}$

(2)

£	s.	d.	
31	2	11	
		3	
93	8	9	for 3
		6	
560	12	6	for 3 × 6 or 18
31	2	11	for 1
591	15	5	for 19
14	13	$1\frac{1}{2}\ \frac{19}{17}q.$	for $\frac{8}{17}$
606	8	$6\frac{1}{2}\ \frac{19}{17}q.$	for $19\frac{8}{17}$

(3)

£	s.	d.	
24	11	$7\frac{1}{2}$	
		4	
98	6	6	for 4
		11	
1081	11	6	for 4 × 11 or 44
49	3	3	for 2
1130	14	9	for 46
9	9	$1\frac{1}{16}$	for $\frac{5}{176}$
1140	3	$10\frac{1}{16}$	for $46\frac{5}{176}$

(4)

tons	cwt.	qrs.	lbs.	oz.	
5	13	3	24	8	
				12	
68	7	2	14	0	for 12
5	13	3	24	8	for 1
74	1	2	10	8	for 13
4	19	2	24	15	for $\frac{7}{8}$
79	1	1	7	7	for $13\frac{7}{8}$

(5)

lbs.	oz.	dwts.	
4	10	15	
		7	
84	15	5	for 7
		3	
102	9	15	for 7 × 3 or 21
2	8	$12\frac{7}{9}$	for $\frac{5}{9}$
105	6	$7\frac{7}{9}$	for $21\frac{5}{9}$

= 105 lbs. 6 oz. 7 dwts. $18\frac{4}{9}$ grs.

(6)

mi.	fur.	po.	
8	3	21	
		10	
84	3	10	for 10
2	2	$30\frac{5}{18}$	for $\frac{5}{18}$
86	6	$0\frac{5}{18}$	for $10\frac{5}{18}$

(7)

£	s.	d.	
16	11	$3\frac{7}{8}$	
		4	
66	5	$3\frac{1}{2}$	for 4
		3	
198	15	$10\frac{1}{2}$	for 4×3 or 12
16	11	$3\frac{7}{8}$	for 1
215	7	$2\frac{3}{8}$	for 13

$= £215.\ 7s.\ 2\frac{1}{4}d.\ \frac{1}{2}q.$

(8)

qrs.	bus.	pks.	
7	5	$3\frac{5}{9}$	
		9	
69	5	0	for 9
		4	
278	4	0	for 9×4 or 36
15	2	$7\frac{1}{9}$	for 2
293	7	$3\frac{1}{9}$	for 38

$= 58$ lds. 3 qrs. 7 bus. 3 pks. $1\frac{1}{9}$ pts.

(9)

£	s.	d.	
13	6	$10\frac{11}{12}$	
		8	
106	14	$10\frac{8}{4}$	for 8
		12	
1280	18	9	for 8×12 or 96
13	6	$10\frac{11}{12}$	for 1
1294	5	$7\frac{11}{12}$	for 97
12	2	$7\frac{89}{1728}$	for $\frac{10}{11}$
1306	8	$2\frac{199}{3456}$	for $97\frac{10}{11}$

$= £1306.\ 8s.\ 2\frac{1}{4}d.\ \frac{31}{96}q.$

(10)

ton	cwt.	qrs.
1	13	$1\frac{36}{119}$
		9
14	19	$3\frac{117}{119}$ for 9
1	10	$2\frac{105}{714}$ for $\frac{11}{12}$
16	10	$1\frac{905}{714}$ for $9\frac{11}{12}$

$=16$ tons, 10 cwt. 1 qr. $23\frac{1}{3}$ lbs.

4.

	£	s.	d.
$23\frac{3}{4}$ yds. of calico at $10\frac{3}{4}d.$ a yd. . $=$	1	1	$3\frac{5}{16}$
$135\frac{3}{8}$ yds. of sheeting at $1s.$ $9\frac{1}{2}d$ a yd. $=$	12	2	$11\frac{15}{16}$
$19\frac{5}{6}$ lbs. of beef at $7\frac{1}{4}d.$ a lb. . . $=$	0	11	$11\frac{19}{24}$
$14\frac{3}{4}$ lbs. of sugar at $9\frac{1}{2}d.$ a lb. . . $=$	0	11	$2\frac{1}{16}$
$27\frac{7}{8}$ lbs. of butter at $1s.$ $4\frac{3}{8}d.$ a lb. $=$	1	18	$7\frac{21}{64}$
	16	6	$1\frac{893}{960}$

$=£16.$ $6s.$ $1\frac{1}{4}d.$ $\frac{141}{240}q.$

5. (1)

£	s.	d.
20	16	$5\frac{1}{9}$
14	15	$0\frac{2}{7}$
5	13	$8\frac{18}{21}$
33	19	$1\frac{1}{3}$
18	3	$5\frac{5}{7}$
93	7	$9\frac{4}{63}$

$$\frac{1}{9}+\frac{2}{7}+\frac{13}{21}+\frac{1}{3}+\frac{5}{7}$$
$$=\frac{7+18+39+21+45}{63}$$
$$=\frac{130}{63}=2\tfrac{4}{63}.$$

(2)

£	s.	d.
2	0	$7\frac{3}{4}$
12	16	$0\frac{4}{4}$
4	14	$8\frac{5}{6}$
10	0	$0\frac{1}{2}$
1	7	$5\frac{5}{8}$
14	15	$7\frac{7}{12}$
45	14	$6\frac{17}{24}$

$$\frac{2}{3}+\frac{3}{4}+\frac{5}{6}+\frac{1}{2}+\frac{3}{8}+\frac{7}{12}$$
$$=\frac{16+18+20+12+9+14}{24}$$
$$=\frac{89}{24}=3\tfrac{17}{24}.$$

$=£45.$ $14s.$ $6\frac{1}{2}d.$ $\frac{5}{6}q.$

6. (1)

£	s.	d.
20	0	0
15	15	$0\frac{3}{7}$
4	4	$11\frac{1}{7}$

(2)

£	s.	d.
2163	1	$7\frac{5}{11}$
364	2	$5\frac{12}{16}$
1798	19	$1\frac{29}{48}$

$=£1798.$ $19s.$ $1\frac{1}{2}d.$ $\frac{5}{12}q.$

$$1\tfrac{5}{12}-\frac{13}{16}=\frac{17}{12}-\frac{13}{16}$$
$$=\frac{68-39}{48}=\frac{29}{48}.$$

7. (1)

	£	s.	d.
	20	6	$7\frac{1}{4}$
			4
3	81	6	6
5	27	2	2
15	5	8	$5\frac{1}{4}$

(2)

	cwt.	qrs.	lbs.
	597	2	8
			3
5	1792	2	24
8	358	2	$4\frac{1}{2}$
	44	3	$7\frac{1}{2}$

$= 44$ cwt. 3 qrs. 7 lbs. $9\frac{3}{4}$ oz.

Ex. XVII. Page 41.

1. (1) $3s.\ 5d. = 41d.$, $£1 = 240d.$;

$$\therefore \text{ fraction} = \frac{41}{240}.$$

$7s.\ 2\frac{1}{2}d. = 173$ halfpence, $£1 = 480$ halfpence;

$$\therefore \text{ fraction} = \frac{173}{480}.$$

$11d. = 11d.$, $£1 = 240d.$;

$$\therefore \text{ fraction} = \frac{11}{240}.$$

$18s.\ 9\frac{3}{4}d. = 903q.$, $£1 = 960q.$,

$$\therefore \text{ fraction} = \frac{903}{960} = \frac{301}{320}.$$

(2) $12s.\ 6d. = 25$ sixpences, 1 guinea $= 42$ sixpences;

$$\therefore \text{ fraction} = \frac{25}{42}.$$

$1s.\ 0\frac{1}{2}d. = 49q.$, 1 guinea $= 1008q.$;

$$\therefore \text{ fraction} = \frac{49}{1008} = \frac{7}{144}.$$

$£1.\ 5s.\ 8\frac{1}{2}d. = 1233q.$, 1 guinea $= 1008q.$;

$$\therefore \text{ fraction} = \frac{1233}{1008} = \frac{137}{112}.$$

(3) $13s.\ 4d. = 160d.$, $£2.\ 0s.\ 9d. = 489d.$;

$$\therefore \text{ fraction} = \frac{160}{489}.$$

$6\frac{1}{2}d. = 13$ halfpence, £2. 0*s*. 9*d*. = 978 halfpence;

$$\therefore \text{ fraction} = \frac{13}{978}.$$

£1. 0*s*. $11\frac{3}{4}d. = 1007q.$, £2. 0*s*. $9d. = 1956q.$;

$$\therefore \text{ fraction} = \frac{1007}{1956}.$$

(4) 18*s*. $4d. = 220d.$, 1 half-guinea = $126d.$;

$$\therefore \text{ fraction} = \frac{220}{126} = \frac{110}{63}.$$

6*s*. $3\frac{3}{7}d. = 75\frac{3}{7}d. = \frac{528}{7}d.$ 1 half-guinea = $126d.$

$$\therefore \text{ fraction} = \frac{\frac{528}{7}}{126} = \frac{528}{7 \times 126} = \frac{264}{441}.$$

$3\frac{1}{4}$ guineas $= \left(\frac{13}{4} \times 2\right)$ half-guineas $= \frac{13}{2}$ half-guineas;

$$\therefore \text{ fraction} = \frac{\frac{13}{2}}{1} = \frac{13}{2}.$$

(5) 2 qrs. 27 lbs. = 83 lbs.; 1 ton = 2240 lbs.

$$\therefore \text{ fraction} = \frac{83}{2240}.$$

15 cwt. 13 lbs. = 1693 lbs.; 1 ton = 2240 lbs.;

$$\therefore \text{ fraction} = \frac{1693}{2240}.$$

3 tons $2\frac{1}{2}$ qrs. $= 242\frac{1}{2}$ qrs. $= \frac{727}{3}$ qrs.; 1 ton = 80 qrs.;

$$\therefore \text{ fraction} = \frac{\frac{727}{3}}{\frac{80}{1}} = \frac{727}{240}.$$

(6) 2 fur. 2 yds. = 442 yds.; 1 mile = 1760 yds.;

$$\therefore \text{ fraction} = \frac{442}{1760} = \frac{221}{880}.$$

30 po. 5 yds. = 170 yds.; 1 mile = 1760 yds.;

$$\therefore \text{fraction} = \frac{170}{1760} = \frac{17}{176}.$$

4 mi. 18 po. 25 in. = 257029 in.; 1 mile = 63360 in.;

$$\therefore \text{fraction} = \frac{257029}{63360}.$$

(7) 1 lb. Avoird. = 7000 grs. Troy; 1 lb. Troy = 5760 grs.;

$$\therefore \text{fraction} = \frac{700}{576} = \frac{175}{144}.$$

6 oz. $4\frac{1}{2}$ dwts. = $124\frac{1}{2}$ dwts.; 1 lb. Troy = 240 dwts.;

$$\therefore \text{fraction} = \frac{124\frac{1}{2}}{240} = \frac{249}{480} = \frac{83}{160}.$$

18 dwts. $7\frac{1}{5}$ grs. = $439\frac{1}{5}$ grs.; 1 lb. Troy = 5760 grs.;

$$\therefore \text{fraction} = \frac{439\frac{1}{5}}{5760} = \frac{2196}{5 \times 5760} = \frac{61}{5 \times 160} = \frac{61}{800}.$$

(8) 1 ro. 12 po. = 52 po.; $2\frac{1}{2}$ ac. = $\left(\frac{5}{2} \times 160\right)$ po. = 400 po.;

$$\therefore \text{fraction} = \frac{52}{400} = \frac{13}{100}.$$

2 ac. 2 yds. = 9682 yds.; $2\frac{1}{4}$ ac. = 12100 yds.;

$$\therefore \text{fraction} = \frac{9682}{12100} = \frac{4841}{6050}.$$

1 ac. 3 po. $13\frac{1}{4}$ yds. = 4944 yds.; $2\frac{1}{4}$ ac. = 12100 yds.;

$$\therefore \text{fraction} = \frac{4944}{12100} = \frac{1236}{3025}.$$

2. 1 franc = $9\frac{3}{4}d.$;

$$\therefore \text{fraction of } £1 = \frac{9\frac{3}{4}}{240} = \frac{39}{960} = \frac{13}{320};$$

$$\therefore \text{fraction of a half sov.} = \frac{9\frac{3}{4}}{120} = \frac{39}{480} = \frac{13}{160};$$

$$\therefore \text{fraction of a crown} = \frac{9\frac{3}{4}}{60} = \frac{39}{240} = \frac{13}{80};$$

$$\therefore \text{fraction of half-a-crown} = \frac{9\frac{3}{4}}{30} = \frac{39}{120} = \frac{13}{40};$$

$\therefore$ fraction of a florin $= \frac{9\frac{3}{4}}{24} = \frac{39}{96} = \frac{13}{32}$;

$\therefore$ fraction of 1 shilling $= \frac{9\frac{3}{4}}{12} = \frac{39}{48} = \frac{13}{16}$;

$\therefore$ fraction of sixpence $= \frac{9\frac{3}{4}}{6} = \frac{39}{24} = \frac{13}{8}$;

$\therefore$ fraction of fourpence $= \frac{9\frac{3}{4}}{4} = \frac{39}{16}$;

$\therefore$ fraction of threepence $= \frac{9\frac{3}{4}}{3} = \frac{39}{12} = \frac{13}{4}$.

Again, a Napoleon $= 20$ francs $= (9\frac{3}{4} \times 20)d. = 195d.$;

$\therefore$ fraction of £1 $= \frac{195}{240} = \frac{13}{16}$;

$\therefore$ fraction of a half sov. $= \frac{195}{120} = \frac{13}{8}$;

$\therefore$ fraction of a crown $= \frac{195}{60} = \frac{13}{4}$;

$\therefore$ fraction of a half-crown $= \frac{195}{30} = \frac{13}{2}$;

$\therefore$ fraction of a florin $= \frac{195}{24} = \frac{65}{8}$;

$\therefore$ fraction of 1 shilling $= \frac{195}{12} = \frac{65}{4}$;

$\therefore$ fraction of sixpence $= \frac{195}{6} = \frac{65}{2}$;

$\therefore$ fraction of fourpence $= \frac{195}{4}$;

$\therefore$ fraction of threepence $= \frac{195}{3} = \frac{65}{1}$.

3. (1) $\frac{3}{4}$ of 1*s.* 6*d.* $= \left(\frac{3}{4} \text{ of } 18\right)d.$; £1 $= 240d.$;

$\therefore$ fraction $= \frac{3 \times 18}{4 \times 240} = \frac{3 \times 3}{4 \times 40} = \frac{9}{160}$.

7. (1)

	£	s.	d.
	20	6	$7\frac{1}{4}$
			4
3	81	6	6
5	27	2	2
	5	8	$5\frac{1}{2}$

(2)

	cwt.	qrs.	lbs.
	597	2	8
			3
5	1792	2	24
8	358	2	$4\frac{4}{5}$
	44	3	$7\frac{2}{5}$

$= 44$ cwt. 3 qrs. 7 lbs. $9\frac{2}{5}$ oz.

Ex. XVII. Page 41.

1. (1) $3s.\ 5d. = 41d.$, $£1 = 240d.$;

$$\therefore \text{ fraction} = \frac{41}{240}.$$

$7s.\ 2\frac{1}{2}d. = 173$ halfpence, $£1 = 480$ halfpence;

$$\therefore \text{ fraction} = \frac{173}{480}.$$

$11d. = 11d.$, $£1 = 240d.$;

$$\therefore \text{ fraction} = \frac{11}{240}.$$

$18s.\ 9\frac{3}{4}d. = 903q.$, $£1 = 960q.$,

$$\therefore \text{ fraction} = \frac{903}{960} = \frac{301}{320}.$$

(2) $12s.\ 6d. = 25$ sixpences, 1 guinea $= 42$ sixpences;

$$\therefore \text{ fraction} = \frac{25}{42}.$$

$1s.\ 0\frac{1}{2}d. = 49q.$, 1 guinea $= 1008q.$;

$$\therefore \text{ fraction} = \frac{49}{1008} = \frac{7}{144}.$$

$£1.\ 5s.\ 8\frac{1}{2}d. = 1233q.$, 1 guinea $= 1008q.$;

$$\therefore \text{ fraction} = \frac{1233}{1008} = \frac{137}{112}.$$

(3) $13s.\ 4d. = 160d.$, $£2.\ 0s.\ 9d. = 489d.$;

$$\therefore \text{ fraction} = \frac{160}{489}.$$

$6\frac{1}{2}d. = 13$ halfpence, £2. 0*s*. $9d. = 978$ halfpence;

$$\therefore \text{ fraction} = \frac{13}{978}.$$

£1. 0*s*. $11\frac{3}{4}d. = 1007q.$, £2. 0*s*. $9d. = 1956q.$;

$$\therefore \text{ fraction} = \frac{1007}{1956}.$$

(4) 18*s*. $4d. = 220d.$, 1 half-guinea $= 126d.$;

$$\therefore \text{ fraction} = \frac{220}{126} = \frac{110}{63}.$$

$6s.\ 3\frac{3}{7}d. = 75\frac{3}{7}d. = \frac{528}{7}d.$ 1 half-guinea $= 126d.$

$$\therefore \text{ fraction} = \frac{\frac{528}{7}}{126} = \frac{528}{7 \times 126} = \frac{264}{441}.$$

$3\frac{1}{2}$ guineas $= \left(\frac{13}{4} \times 2\right)$ half-guineas $= \frac{13}{2}$ half-guineas;

$$\therefore \text{ fraction} = \frac{\frac{13}{2}}{1} = \frac{13}{2}.$$

(5) 2 qrs. 27 lbs. $= 83$ lbs.; 1 ton $= 2240$ lbs.

$$\therefore \text{ fraction} = \frac{83}{2240}.$$

15 cwt. 13 lbs. $= 1693$ lbs.; 1 ton $= 2240$ lbs.;

$$\therefore \text{ fraction} = \frac{1693}{2240}.$$

3 tons $2\frac{1}{2}$ qrs. $= 242\frac{1}{2}$ qrs. $= \frac{727}{3}$ qrs.; 1 ton $= 80$ qrs.;

$$\therefore \text{ fraction} = \frac{\frac{727}{3}}{\frac{80}{1}} = \frac{727}{240}.$$

(6) 2 fur. 2 yds. $= 442$ yds.; 1 mile $= 1760$ yds.;

$$\therefore \text{ fraction} = \frac{442}{1760} = \frac{221}{880}.$$

30 po. 5 yds. = 170 yds.; 1 mile = 1760 yds.;

$$\therefore \text{fraction} = \frac{170}{1760} = \frac{17}{176}.$$

4 mi. 18 po. 25 in. = 257029 in.; 1 mile = 63360 in.;

$$\therefore \text{fraction} = \frac{257029}{63360}.$$

(7) 1 lb. Avoird. = 7000 grs. Troy; 1 lb. Troy = 5760 grs.;

$$\therefore \text{fraction} = \frac{700}{576} = \frac{175}{144}.$$

6 oz. $4\frac{1}{2}$ dwts. = $124\frac{1}{2}$ dwts.; 1 lb. Troy = 240 dwts.;

$$\therefore \text{fraction} = \frac{124\frac{1}{2}}{240} = \frac{249}{480} = \frac{83}{160}.$$

18 dwts. $7\frac{1}{5}$ grs. = $439\frac{1}{5}$ grs.; 1 lb. Troy = 5760 grs.;

$$\therefore \text{fraction} = \frac{439\frac{1}{5}}{5760} = \frac{2196}{5 \times 5760} = \frac{61}{5 \times 160} = \frac{61}{800}.$$

(8) 1 ro. 12 po. = 52 po.; $2\frac{1}{2}$ ac. = $\left(\frac{5}{2} \times 160\right)$ po. = 400 po.;

$$\therefore \text{fraction} = \frac{52}{400} = \frac{13}{100}.$$

2 ac. 2 yds. = 9682 yds.; $2\frac{1}{2}$ ac. = 12100 yds.;

$$\therefore \text{fraction} = \frac{9682}{12100} = \frac{4841}{6050}.$$

1 ac. 3 po. $13\frac{1}{4}$ yds. = 4944 yds.; $2\frac{1}{2}$ ac. = 12100 yds.;

$$\therefore \text{fraction} = \frac{4944}{12100} = \frac{1236}{3025}.$$

2. 1 franc = $9\frac{3}{4}d.$;

$$\therefore \text{fraction of £1} = \frac{9\frac{3}{4}}{240} = \frac{39}{960} = \frac{13}{320};$$

$$\therefore \text{fraction of a half sov.} = \frac{9\frac{3}{4}}{120} = \frac{39}{480} = \frac{13}{160};$$

$$\therefore \text{fraction of a crown} = \frac{9\frac{3}{4}}{60} = \frac{39}{240} = \frac{13}{80};$$

$$\therefore \text{fraction of half-a-crown} = \frac{9\frac{3}{4}}{30} = \frac{39}{120} = \frac{13}{40};$$

$\therefore$ fraction of a florin $= \frac{9\frac{3}{4}}{24} = \frac{39}{96} = \frac{13}{32}$;

$\therefore$ fraction of 1 shilling $= \frac{9\frac{3}{4}}{12} = \frac{39}{48} = \frac{13}{16}$;

$\therefore$ fraction of sixpence $= \frac{9\frac{3}{4}}{6} = \frac{39}{24} = \frac{13}{8}$;

$\therefore$ fraction of fourpence $= \frac{9\frac{3}{4}}{4} = \frac{39}{16}$;

$\therefore$ fraction of threepence $= \frac{9\frac{3}{4}}{3} = \frac{39}{12} = \frac{13}{4}$.

Again, a Napoleon $= 20$ francs $= (9\frac{3}{4} \times 20)d. = 195d.$;

$\therefore$ fraction of £1 $= \frac{195}{240} = \frac{13}{16}$;

$\therefore$ fraction of a half sov. $= \frac{195}{120} = \frac{13}{8}$;

$\therefore$ fraction of a crown $= \frac{195}{60} = \frac{13}{4}$;

$\therefore$ fraction of a half-crown $= \frac{195}{30} = \frac{13}{2}$;

$\therefore$ fraction of a florin $= \frac{195}{24} = \frac{65}{8}$;

$\therefore$ fraction of 1 shilling $= \frac{195}{12} = \frac{65}{4}$;

$\therefore$ fraction of sixpence $= \frac{195}{6} = \frac{65}{2}$;

$\therefore$ fraction of fourpence $= \frac{195}{4}$;

$\therefore$ fraction of threepence $= \frac{195}{3} = \frac{65}{1}$.

3. (1) $\frac{3}{4}$ of 1*s.* 6*d.* $= \left(\frac{3}{4} \text{ of } 18\right)d.$; £1 $= 240d.$;

$\therefore$ fraction $= \frac{3 \times 18}{4 \times 240} = \frac{3 \times 3}{4 \times 40} = \frac{9}{160}$.

$\frac{8}{9}$ of half-a-crown $= \left(\frac{8}{9} \times 5\right)$ sixpences; £1 = 40 sixpences;

$$\therefore \text{fraction} = \frac{\frac{8 \times 5}{9}}{\frac{40}{1}} = \frac{8 \times 5}{9 \times 40} = \frac{1}{9}.$$

(2) $\frac{3}{5}$ of 17*s.* 6*d.* $= \left(\frac{3}{5} \text{ of } 35\right)$ sixpences $= 21$ sixpences;

1 guinea $= 42$ sixpences;

$$\therefore \text{fraction} = \frac{21}{42} = \frac{1}{2}.$$

$\frac{4}{7}q. = \frac{4}{7}q.$, 1 guinea $= 1008\,q.$;

$$\therefore \text{fraction} = \frac{\frac{4}{7}}{\frac{1008}{1}} = \frac{4}{7 \times 1008} = \frac{1}{1764}.$$

(3) $\frac{12}{25}$ of £20 $= \left(\frac{12 \times 4}{5}\right)$£, £100 = £100;

$$\therefore \text{fraction} = \frac{\frac{12 \times 4}{5}}{\frac{100}{1}} = \frac{12 \times 4}{5 \times 100} = \frac{12}{125}.$$

$\frac{3}{5}$ of $7\frac{1}{2}$ guineas $= \left(\frac{3}{5} \text{ of } \frac{15}{2}\right)$ guineas $= \frac{9}{2}$ guineas $= \left(\frac{9}{2} \times 21\right)s.$;

£100 $= (100 \times 20)s.$;

$$\therefore \text{fraction} = \frac{\frac{9 \times 21}{2}}{100 \times 20} = \frac{189}{4000}.$$

4. (1) $\frac{5}{9}$ of $\frac{3}{7}$ of $\frac{2}{5}$ of a yd. $= \frac{2}{21}$ yd.; 2 miles = 3520 yds.;

$$\therefore \text{fraction} = \frac{\frac{2}{21}}{3520} = \frac{2}{21 \times 3520} = \frac{1}{21 \times 1760} = \frac{1}{36960}.$$

(2) $\frac{4}{5}$ of $1\frac{1}{6}$ of $3\frac{3}{4}$ sq. yds. $= \left(\frac{4}{5} \text{ of } \frac{11}{6} \text{ of } \frac{15}{4}\right)$ sq. yds.

$= \frac{11}{2}$ sq. yds.

$\frac{4}{11}$ of 2 ac. $= \left(\frac{4}{11} \text{ of } 9680\right)$ sq. yds.

$\therefore$ fraction $= \frac{\frac{11}{2}}{\frac{4}{11} \times 9680} = \frac{11 \times 11}{2 \times 4 \times 9680} = \frac{1}{640}$.

MISCELLANEOUS EXAMPLES IN VULGAR FRACTIONS.—Ex. XVIII. Page 49.

1. (1) Ans. $= 8 \div \frac{1}{5} = 8 \times 5 = 40$;

Ans. $= \frac{3}{8} \div \frac{1}{5} = \frac{3}{8} \times 5 = \frac{15}{8}$.

(2) Difference $= 3\frac{1}{12} \div 2 = \frac{47}{24} = 1\frac{23}{24}$;

$\therefore$ other No. $= 4\frac{7}{8} - 1\frac{23}{24} = (3-1) + \left(\frac{45}{24} - \frac{23}{24}\right) = 2\frac{22}{24} = 2\frac{11}{12}$.

2. $\frac{5}{7}$ of distance $= 1742$ m.;

$\therefore \frac{1}{7}$ of distance $= \frac{1742}{5}$ m.;

$\therefore$ distance $= \frac{1742 \times 7}{5}$ m. $= \frac{12194}{5}$ m.

$= 24388$ décim. $= 2$ kilom. 4 hectom. 3 décam. 8 m. 8 décim.

3. $\frac{10}{12}$ or $\frac{5}{6}$ of piece of work is worth 6030*s.*;

$\therefore \frac{1}{6}$ ..... $\frac{6030}{5}$ *c.* or 1206*c.*;

$\therefore$ piece of work is worth $1206c. \times 6 = 7236c. = 72fr.\ 36c.$

4. (1) $\text{No.} = \frac{6}{18} - \frac{15}{63} = \frac{1}{3} - \frac{15}{63} = \frac{21-15}{63} = \frac{6}{63} = \frac{2}{21}$.

(2) $\text{No.} = 365\frac{1}{4} \div 9\frac{3}{5} = \frac{1461}{4} \times \frac{8}{75} = \frac{487 \times 2}{25} = \frac{974}{25} = 38\frac{24}{25}$.

5. No. of pages remaining $= 436 - 126 = 310$;

$\therefore$ fraction required $= \frac{310}{436} = \frac{155}{218}$;

excess $= \left(\frac{155}{218} - \frac{1}{3}\right)$ of 436 pages $= \frac{247}{654}$ of 436 pages

$= \frac{494}{3}$ pages $= 164\frac{2}{3}$ pages.

6. The boy gives $\frac{1}{3}$ of cake to A, $\therefore \frac{2}{3}$ of cake remains;

..... $\frac{1}{4}$ of $\frac{2}{3}$ or $\frac{1}{6}$ of cake to B,

$\therefore \frac{2}{3} - \frac{1}{6}$, or $\frac{1}{2}$ of cake remains;

..... $\frac{1}{2}$ of $\frac{1}{2}$ or $\frac{1}{4}$ of cake to C,

$\therefore \frac{1}{2} - \frac{1}{4}$ or $\frac{1}{4}$ of cake remains;

$\therefore$ Ans. $= \left(\frac{1}{3} - \frac{1}{4}\right)$ of cake $= \frac{1}{12}$ of cake.

7. $\text{Ans.} = \left(\frac{1}{4} + \frac{3}{8} + \frac{5}{6} + \frac{23}{24}\right) - \left(\frac{1}{3} + \frac{2}{9} + \frac{3}{8} + \frac{5}{16}\right)$

$= \frac{6+9+20+23}{24} - \frac{48+32+54+45}{144}$

$= \frac{58}{24} - \frac{179}{144} = \frac{348-179}{144} = \frac{169}{144} = 1\frac{25}{144}$.

8. Portion sold $= \left(\frac{1}{5} + \frac{3}{4} \text{ of } \frac{4}{5}\right) = \frac{1}{5} + \frac{3}{5} = \frac{4}{5}$;

$\therefore \frac{1}{5}$ of piece of cloth $= 27$ m. 54 millim. $= 27054$ millim.

$\therefore$ piece of cloth $= 135270$ millim.

$= 135$ m. 27 centim.

9. 125 volumes cost 85*fr.* or 8500*c.*;

$\therefore$ 1 volume cost $\frac{8500}{125}c.$ or 68*c.*

10. In 1 day A does $\frac{1}{2\frac{1}{2}}$ or $\frac{2}{5}$ of work;

..... B does $\frac{1}{3\frac{1}{3}}$ or $\frac{3}{10}$ .....

$\therefore$ ..... $A+B$ do $\left(\frac{2}{5}+\frac{3}{10}\right)$ or $\frac{7}{10}$ .....

11. By question,

whole sum $-\frac{1}{2}$ whole sum $-\frac{2}{3}$ of $\frac{1}{2}$ of whole sum $=5s.\ 3d.$;

or $\left(1-\frac{1}{2}-\frac{1}{3}\right)$ of whole sum $=5s.\ 3d.$;

or $\frac{1}{6}$ of whole sum $=5s.\ 3d.$;

$\therefore$ whole sum $=5s.\ 3d. \times 6 = £1.\ 11s.\ 6d.$;

$\therefore$ the money was divided thus, $15s.\ 9d.$, $10s.\ 6d.$, $5s.\ 3d.$

12. There are 27 boys, and 26 girls;

$\therefore$ No. of cakes required $=\frac{1}{5}\times 26+\left(\frac{1}{5}+\frac{1}{10}\right)\times 27$

$$=\frac{26}{5}+\frac{81}{10}=\frac{52+81}{10}=\frac{133}{10}=13\tfrac{3}{10}.$$

13. $\frac{3+4}{4+5}$ of $£2\frac{1}{2}=\frac{7}{9}$ of $£2\frac{1}{2}=£\left(\frac{7}{9}\times\frac{5}{2}\right)=£\frac{35}{18}$;

$\frac{3}{4}$ of $£2\frac{1}{2}=£\left(\frac{3}{4}$ of $\frac{5}{2}\right)=£\frac{15}{8}$;

$\frac{4}{5}$ of $£2\frac{1}{2}=£\left(\frac{4}{5}$ of $\frac{5}{2}\right)=£2.$

Comparing the fractions $\frac{35}{18}$ and $\frac{15}{8}$, or $\frac{140}{72}$ and $\frac{135}{72}$, we see

$\therefore$ a bullock is worth £$\left(\frac{10}{7} \times 14\right)$ or £20;

$\therefore$ 50 bullocks are worth £20 × 50 = £1000.

21. (125 × 90) kilogs. cost 450 *fr.*;

$\therefore$ 1 kilog. ..... $\frac{450}{125 \times 90}$ *fr.* = $\frac{1}{25}$ *fr.*;

$\therefore$ (340 × 80) kilogs. ..... $\left(\frac{1}{25} \times 340 \times 80\right)$ *fr.* = 1088 *fr.*

22. *A* receives $\frac{1}{3}$ of £13. 2*s.* 6*d.* or £4. 7*s.* 6*d.*

B ..... $\frac{1}{7}$ ..... £1. 17*s.* 6*d.*

£13. 2*s.* 6*d.* − (£4. 7*s.* 6*d.* + £1. 17*s.* 6*d.*) = £6. 17*s.* 6*d.*

A receives $\frac{4}{11}$ of £6. 17*s.* 6*d.* = £2. 10*s.*, and *B* receives £6. 17*s.* 6*d.* − £2. 10*s.* = £4. 7*s.* 6*d.*;

$\therefore$ *A* receives £4. 7*s.* 6*d.* + £2. 10*s.* = £6. 17*s.* 6*d.*,
and *B* ..... £1. 17*s.* 6*d.* + £4. 7*s.* 6*d.* = £6. 5*s.*

23. Wheat + pasture = $\left(\frac{2}{7} + \frac{4}{9}\right)$ or $\frac{46}{63}$ of farm;

$\therefore \left(1 - \frac{46}{63}\right)$ or $\frac{17}{63}$ of farm = 24 ac. 2 ro. 7 po.;

$\therefore \frac{1}{63}$ of farm = $\frac{1}{17}$ of 24 ac. 2 ro. 7 po., or 1 ac. 1 ro. 31 po.;

$\therefore$ farm = 1 ac. 1 ro. 31 po. × 63 = 90 ac. 3 ro. 33 po.

24 9 boys = 6 men; $\therefore$ 1 boy = $\frac{6}{9}$ or $\frac{2}{3}$ of man;

$\therefore$ 6 boys = $\left(\frac{2}{3} \times 6\right)$ men = 4 men;

$\therefore$ 13 men and 6 boys = 13 men and 4 men = 17 men.

Now 6 men can weed $\frac{1}{3}$ of field in 17 d.

$\therefore$ 6 men can weed $\frac{2}{3}$ of field in 34 d.;

$\therefore$ 1 man ..... (34×6) d.

$\therefore$ 17 men ..... $\frac{34 \times 6}{17}$ d. $= 12$ d.

25. No. of votes polled for winning candidate

$= (2067 - 189) \div 2 + 189 = 1128$;

$\therefore$ fraction required $= \frac{1128}{2067} = \frac{376}{689}$.

26. (1) $£8\frac{3}{5} + £8 \times \frac{3}{5} = £8.\ 12s. + £4.\ 16. = £13.\ 8c.$

$\therefore$ fraction required $= \frac{268}{200} = \frac{67}{50}$.

(2) $\frac{3}{8}$ of a ton of sugar cost $£\frac{25}{2}$;

$\therefore$ 1 ton ..... $£\left(\frac{25}{2} \times \frac{8}{3}\right)$, or $£\frac{100}{3}$;

$\therefore$ $1\frac{1}{2}$ ..... $£\left(\frac{100}{3} \times \frac{4}{3}\right)$,

or £44. 8*s*. $10\frac{1}{2}$*d*. $\frac{1}{2}$*q*.

27. In 8 days the reapers cut down $\frac{1}{3}$ of crop.

If 60 ..... $\frac{1}{3}$ of crop in 8 days,

120 ..... $\frac{2}{3}$ .....;

$\therefore$ 1 reaper cuts down $\frac{2}{3}$ ..... (8×120) d.;

$\therefore$ 48 reapers cut down $\frac{2}{3}$ ..... $\frac{8 \times 120}{48}$ or 20 d.

28. 7 women make a certain no. of shirts in $7\frac{1}{2}$d. of $9\frac{3}{8}$ hr.;

$\therefore$ ..... that no. $\times 4$ ..... in $(7\frac{1}{2} \times 4)$ d. of $9\frac{3}{8}$ hr.;

$\therefore$ 1 woman makes ..... in $(7\frac{1}{2} \times 4 \times 7)$ d. of $9\frac{3}{8}$ hr.;

$\therefore$ ..... in $(7\frac{1}{2} \times 4 \times 7 \times 9\frac{3}{8})$ d. of 1 hr.;

$\therefore$ ..... in $\dfrac{7\frac{1}{2} \times 4 \times 7 \times 9\frac{3}{8}}{15\frac{1}{4}}$ d. of $15\frac{1}{4}$ hr.;

$\therefore$ 19 women make ..... in $\dfrac{7\frac{1}{2} \times 4 \times 7 \times 9\frac{3}{8}}{15\frac{1}{4} \times 19}$ d. of $15\frac{1}{4}$ hr.

in 7 d. of $15\frac{1}{4}$ hr.

29. When wheat is 5*s.* a bus., 6 oz. of bread cost 1*d.*;

$\therefore$ ..... 1*s.* ..... $\dfrac{1}{5}d.$;

$\therefore$ ..... 1 oz. ..... $\dfrac{1}{5 \times 6}d.$;

$\therefore$ ..... 7*s.* 6*d.* ..... $\dfrac{15}{2 \times 5 \times 6}d.$;

$\therefore$ ..... 72 oz. ..... $\dfrac{15 \times 72}{2 \times 5 \times 6}d.$;

$= 18d.$ or 1*s.* 6*d.*

30. One pipe fills $\dfrac{1}{6}$ in 1 hr.;

the other .... $\dfrac{1}{20}$ ..... ;

$\therefore$ both pipes fill $\left(\dfrac{1}{6} + \dfrac{1}{20}\right)$ or $\dfrac{13}{60}$ in 1 hr.

31. 1st pipe in 1 hr. 20 mi. would fill $\dfrac{1}{6} \times 1\frac{1}{3}$ or $\dfrac{2}{9}$ of reservoir;

$\therefore \dfrac{7}{9}$ remains to be filled.

Both pipes fill $\dfrac{13}{60}$ in 1 hr.;

$\therefore$ ..... $\dfrac{1}{60}$ in $\dfrac{1}{13}$ hr.;

$\therefore$ both pipes fill cistern in $\frac{60}{13}$ hr.;

$\therefore$ ..... $\frac{7}{9}$ cistern in $\frac{7 \times 60}{9 \times 13}$ hr. $= 3\frac{2}{39}$ hr.;

$\therefore$ time required $= (1\frac{1}{3} + 3\frac{2}{39})$ hr. $= 4\frac{13}{39}$ hr.

32. $(4\frac{1}{12})s.$ or $\frac{49}{12}s.$ are worth 12 Carlini;

$\therefore$ $1s.$ is worth $\frac{12 \times 12}{49}$ Carlini;

$\therefore$ $16s.$ ..... $\frac{12 \times 12}{49} \times 16$ Carlini;

$\therefore$ $(16s. \times 98)$ or 98 Nap. are worth $\frac{12 \times 12 \times 16 \times 98}{49}$ Carlini

$= 4608$ .....

33. Representing the work by unity, or 1,

in one day A does $\frac{1}{5}$ part of the work;

..... B ..... $\frac{1}{3}$ .....

..... C ..... $\frac{4}{9}$ .....

..... $A+B+C$ do $\left(\frac{1}{5} + \frac{1}{3} + \frac{4}{9}\right)$ or $\frac{44}{45}$ part;

$\therefore$ time in which $A+B+C$ would finish the work $= \frac{1}{\frac{44}{45}}$ d. or $\frac{45}{44}$ d.;

$\therefore$ .... $5\frac{1}{2}$ times the work $= \left(\frac{45}{44} \times \frac{11}{2}\right)$ d. $= 5\frac{5}{8}$ d.

34. Representing the work by unity, or 1,

in 1 day $A+B$ do $\left(\frac{1}{15} + \frac{1}{18}\right)$ of the work;

in 3 days they do $\left(\frac{1}{15} + \frac{1}{18}\right) \times 3$ ..... or $\frac{11}{30}$;

$\therefore$ $\frac{19}{30}$ of the work remains to be done.

In 3 days more A does $\frac{3}{15}$ or $\frac{1}{5}$ of the work;

$\therefore$ when A is joined by C, $\frac{19}{30} - \frac{1}{5}$, or $\frac{13}{30}$ of the work remains to be done.

In 4 days more A does $\frac{4}{15}$ of the work;

$\therefore$ work which has to be done by C in 4 days $= \frac{13}{30} - \frac{4}{15} = \frac{5}{30} = \frac{1}{6}$;

$\therefore$ ..... C in 1 day $= \frac{1}{6} \div 4 = \frac{1}{24}$;

$\therefore$ time in which C would do the whole work $= 24$ days.

35. $\frac{1}{2} + \frac{1}{5} + \frac{1}{6} = \frac{13}{15}$;

$\therefore \frac{2}{15}$ of fortune $= £2000$;

$\therefore \frac{1}{15}$ ..... $= £1000$;

$\therefore$ fortune $= £15000$.

36. No. of oranges received by 1st boy $= \frac{1}{2}$ given no. $+1$;

$\therefore$ No. of oranges left $= \frac{1}{2}$ given no. -1 ..... (1)

No. of oranges received by 2nd boy $= \frac{1}{2}$ of $\left(\frac{1}{2} \text{ given no.} - 1\right) + 1$

$= \frac{1}{4}$ of given no. $- \frac{1}{2} + 1 = \frac{1}{4}$ given no. $+ \frac{1}{2}$ ..... (2)

$\therefore$ No. of oranges left $=$ (1) $-$ (2)

$= \frac{1}{2}$ given no. $- 1 - \frac{1}{4}$ given no. $- \frac{1}{2}$

$= \left(\frac{1}{2} - \frac{1}{4}\right)$ given no. $- \left(1 + \frac{1}{2}\right)$

$= \frac{1}{4}$ given no. $- \frac{3}{2}$ ..... (3)

No. of oranges received by 3rd boy $= \frac{1}{2}$ of $\left(\frac{1}{4} \text{ given no.} - \frac{3}{2}\right) + 1$

$= \frac{1}{8}$ of given no. $- \frac{3}{4} + 1 = \frac{1}{8}$ of given no. $+ \frac{1}{4}$ ..... (4)

$\therefore$ No. of oranges left $= (3) - (4)$

$= \frac{1}{4}$ of given no. $- \frac{3}{2} - \frac{1}{8}$ of given no. $- \frac{1}{4}$

$= \left(\frac{1}{4} - \frac{1}{8}\right)$ of given no. $- \left(\frac{3}{2} + \frac{1}{4}\right)$

$= \frac{1}{8}$ of given no. $- \frac{7}{4}$ ..... (5)

$\therefore$ No. of oranges received by 4th boy

$= \frac{1}{2}$ of $\left(\frac{1}{8} \text{ of given no.} - \frac{7}{4}\right) + 1$

$= \frac{1}{16}$ of given no. $- \frac{7}{8} + 1 = \frac{1}{16}$ of given no. $+ \frac{1}{8}$ ..... (6)

$\therefore$ No. of oranges left $= (5) - (6)$

$= \frac{1}{8}$ of given no. $- \frac{7}{4} - \frac{1}{16}$ of given no. $- \frac{1}{8}$

$= \left(\frac{1}{8} - \frac{1}{16}\right)$ of given no. $- \left(\frac{7}{4} + \frac{1}{8}\right)$

$= \frac{1}{16}$ of given no. $- \frac{15}{8}$;

$\therefore$ by the question,

$\frac{1}{16}$ of given no. $= \frac{15}{8}$;

$\therefore$ given no. $= \frac{15}{8} \times 16 = 30$.

37. No. of parts $= (15 + 3 + 2) = 20$;

$\therefore$ quantity of Nitre $= \left(\frac{15}{20} \text{ of } 100\right)$ kilog. $= 75$ kilog.

..... Charcoal $= \left(\frac{3}{20} \text{ of } 100\right)$ kilog. $= 15$ .....

..... Sulphur $= \left(\frac{2}{20} \text{ of } 100\right)$ kilog. $= 10$ .....

38. When A gets £8, B gets £6, and C gets £5;

$\therefore$ A gets $\frac{8}{19}$ of £5937. 10*s.* = £2500;

B ..... $\frac{6}{19}$ of £5937. 10*s.* = £1875;

C ..... $\frac{5}{19}$ of £5937. 10*s.* = £1562. 10*s.*

39. A's share $= \frac{5}{9}$ B's share;

$\therefore$ A's share + B's share $= \frac{5}{9}$ B's share + B's share

$= \left(\frac{5}{9}+1\right)$ of B's share

$= \frac{14}{9}$ of B's share;

$\therefore$ C's share $= \frac{14}{9}$ B's share + 16 guineas;

$\therefore$ $\frac{14}{9}$ B's share + $\frac{14}{9}$ B's share = £658 − £16. 16*s.*

= £641. 4*s.*;

$\therefore$ $\frac{28}{9}$ B's share = £641. 4*s.*

$\therefore$ B's share $= \frac{9}{28}$ of £641. 4*s.* = £206. 2*s.*;

$\therefore$ A's share $= \frac{5}{9}$ of £206. 2*s.* = £114. 10*s.*;

$\therefore$ C's share = £206. 2*s.* + £114. 10*s.* + £16. 16*s.*

= £337. 8*s.*

40. The best sewer received a certain no. of shillings × 1

... 2 next ..... that no. of shillings × 2 less 10*s.*

... 3 ..... × 3 ... 22*s.* 6*d.*

... 10 ..... × 10 ... 90*s.*

... 10 ..... × 10 ... 100*s.*

... 4 ..... × 4 ... 50*s.*

$\therefore$ all the sewers received a certain no. of shillings$\times$30 less 272*s.* 6*d.*;

$\therefore$ by the question,

the no. of shillings received by best sewer $\times$ 30

$= 177s.\ 6d. + 272s.\ 6d. = 450s.$;

$\therefore$ best sewer receives $= 450s. \div 30 = 15s.$;

$\therefore$ best sewer receives $\frac{15}{177\frac{1}{2}}$, or $\frac{6}{71}$ of whole amount,

2nd class ..... $\frac{20}{177\frac{1}{2}}$, or $\frac{8}{71}$ .....

3rd ..... $\frac{22\frac{1}{2}}{177\frac{1}{2}}$, or $\frac{9}{71}$ .....

4th ..... $\frac{60}{177\frac{1}{2}}$, or $\frac{24}{71}$ .....

5th ..... $\frac{50}{177\frac{1}{2}}$, or $\frac{20}{71}$ .....

6th ..... $\frac{10}{177\frac{1}{2}}$, or $\frac{4}{71}$ .....

Now $\frac{8}{71} = \frac{4}{71} \times 2$;

$\therefore$ 2nd class received twice as much as last class.

DECIMALS.—Ex. XIX. Page 57.

1. (1) $\frac{7}{10}$; $\frac{37}{100}$; $\frac{561}{1000}$; $\frac{13103}{100000}$; $\frac{450909}{1000000}$.

(2) $\cdot 45 = \frac{45}{100} = \frac{9}{20}$; $\cdot 025 = \frac{25}{1000} = \frac{1}{40}$;

$\cdot 40 = \frac{40}{100} = \frac{2}{5}$; $\cdot 0008 = \frac{8}{10000} = \frac{1}{1250}$;

$\cdot 000050 = \frac{50}{1000000} = \frac{1}{20000}$.

(3) $45{\cdot}3=\frac{453}{10}$; $4{\cdot}00013=\frac{400013}{100000}$;

$$796{\cdot}000900=\frac{796000900}{1000000}=\frac{7960009}{10000};$$

$$1000{\cdot}0001=\frac{10000001}{10000}.$$

2. (1) ·5; ·005; ·53; 343·4; ·0302.

(2) 2137·2; 300·0088; ·0083276; ·00000001.

(3) ·9; ·023; ·000001; 7·017; 200·00002.

3. Nineteen hundredths; five hundredths; five and one tenth; three and two hundred and forty-one thousandths; forty-seven thousand five hundred and sixty-one hundred thousandths; fifty thousand and twenty-five millionths; one and twenty millions and two hundred millionths.

4. $\cdot6\times10=\frac{6}{10}\times10=6$, $\cdot6\times100=\frac{6}{10}\times100=60$,

$$\cdot6\times1000=\frac{6}{10}\times1000=600,$$

$$\cdot6\times100000=\frac{6}{10}\times100000=60000;$$

$$\cdot07\times10=\frac{7}{100}\times10=\frac{7}{10}=\cdot7,$$

$$\cdot07\times100=\frac{7}{100}\times100=7,$$

$$\cdot07\times1000=\frac{7}{100}\times1000=70,$$

$$\cdot07\times100000=\frac{7}{100}\times100000=7000;$$

$$22{\cdot}066\times10=\frac{22066}{1000}\times10=\frac{22066}{100}=220{\cdot}66,$$

$$22{\cdot}066\times100=\frac{22066}{1000}\times100=\frac{22066}{10}=2206{\cdot}6,$$

$$22{\cdot}066 \times 1000 = \frac{22066}{1000} \times 1000 = 22066,$$

$$22{\cdot}066 \times 100000 = \frac{22066}{1000} \times 100000 = 22066 \times 100 = 2206600.$$

5. $39{\cdot}045 \div 10 = \frac{39045}{1000} \times \frac{1}{10} = \frac{39045}{10000} = 3{\cdot}9045,$

$$39{\cdot}045 \div 100 = \frac{39045}{1000} \times \frac{1}{100} = \frac{39045}{100000} = {\cdot}39045,$$

$$39{\cdot}045 \div 10000 = \frac{39045}{1000} \times \frac{1}{10000} = \frac{39045}{10000000} = {\cdot}0039045,$$

$$39{\cdot}045 \div 1000000 = \frac{39045}{1000} \times \frac{1}{1000000}$$

$$= \frac{39045}{1000000000} = {\cdot}00039045;$$

$$512{\cdot}05 \div 10 = \frac{51205}{100} \times \frac{1}{10} = \frac{51205}{1000} = 51{\cdot}205,$$

$$512{\cdot}05 \div 100 = \frac{51205}{100} \times \frac{1}{100} = \frac{51205}{10000} = 5{\cdot}1205,$$

$$512{\cdot}05 \div 10000 = \frac{51205}{100} \times \frac{1}{10000} = \frac{51205}{1000000} = {\cdot}051205,$$

$$512{\cdot}05 \div 1000000 = \frac{51205}{100} \times \frac{1}{1000000} = \frac{51205}{100000000} = {\cdot}00051205.$$

ADDITION OF DECIMALS.—Ex. XX. Page 58.

1. (1)

$$\begin{array}{r} 3{\cdot}25 \\ 42{\cdot}348 \\ 748{\cdot}4 \\ 29{\cdot}32 \\ \hline 823{\cdot}318 \end{array}$$

$$3{\cdot}25 + 42{\cdot}348 + 748{\cdot}4 + 29{\cdot}32$$

$$= \frac{325}{100} + \frac{42348}{1000} + \frac{7484}{10} + \frac{2932}{100}$$

$$= \frac{3250}{1000} + \frac{42348}{1000} + \frac{748400}{1000} + \frac{29320}{1000}$$

$$= \frac{823318}{1000} = 823{\cdot}318.$$

(2)
$$\begin{array}{r} 672{\cdot}5 \\ 4{\cdot}923 \\ 80{\cdot} \\ {\cdot}0764 \\ \hline 757{\cdot}4994 \end{array}$$

$$672{\cdot}5+4{\cdot}923+80+{\cdot}0764$$
$$=\frac{6725}{10}+\frac{4923}{1000}+\frac{80}{1}+\frac{764}{10000}$$
$$=\frac{6725000}{10000}+\frac{49230}{10000}+\frac{800000}{10000}+\frac{764}{10000}$$
$$=\frac{7574994}{10000}=757{\cdot}4994.$$

(3)
$$\begin{array}{r} 72{\cdot}5 \\ 140{\cdot} \\ 340{\cdot}03 \\ 21{\cdot}5715 \\ 4{\cdot}00087 \\ \hline 578{\cdot}10237 \end{array}$$

$$72{\cdot}5+140+340{\cdot}03+21{\cdot}5715+4{\cdot}00087$$
$$=\frac{725}{10}+\frac{140}{1}+\frac{34003}{100}+\frac{215715}{10000}+\frac{400087}{100000}$$
$$=\frac{7250000}{100000}+\frac{14000000}{100000}+\frac{34003000}{100000}+\frac{2157150}{100000}+\frac{400087}{100000}$$
$$=\frac{57810237}{100000}=578{\cdot}10237.$$

(4)
$$\begin{array}{r} {\cdot}96 \\ 7{\cdot}3004 \\ 8010{\cdot} \\ {\cdot}00093 \\ 124650{\cdot} \\ \hline 132668{\cdot}26133 \end{array}$$

$${\cdot}96+7{\cdot}3004+8010+{\cdot}00093+124650$$
$$=\frac{96}{100}+\frac{73004}{10000}+\frac{8010}{1}+\frac{93}{100000}+\frac{124650}{1}$$
$$=\frac{96000}{100000}+\frac{730040}{100000}+\frac{801000000}{100000}+\frac{93}{100000}+\frac{12465000000}{100000}$$
$$=\frac{13266826133}{100000}=132668{\cdot}26133.$$

(5)

$$\begin{array}{r} 2{\cdot}8146 \\ {\cdot}093845 \\ 8{\cdot} \\ {\cdot}875 \\ 231{\cdot}2788 \\ 4{\cdot}00875 \\ \hline 247{\cdot}070995 \end{array}$$

$$2{\cdot}8146+{\cdot}093845+8+{\cdot}875+231{\cdot}2788+4{\cdot}00875$$

$$=\frac{28146}{10000}+\frac{93845}{1000000}+\frac{8}{1}+\frac{875}{1000}+\frac{2312788}{10000}+\frac{400875}{100000}$$

$$=\frac{2814600+93845+8000000+875000+231278800+4008750}{1000000}$$

$$=\frac{247070995}{1000000}=247{\cdot}070995.$$

(6)

$$\begin{array}{r} 12{\cdot}30046 \\ 6732{\cdot}56 \\ {\cdot}0004 \\ 4570{\cdot} \\ 1{\cdot}3200006 \\ \hline 11316{\cdot}1808606 \end{array}$$

$$12{\cdot}30046+6732{\cdot}56+{\cdot}0004+4570+1{\cdot}3200006$$

$$=\frac{1230046}{100000}+\frac{673256}{100}+\frac{4}{10000}+\frac{4570}{1}+\frac{13200006}{10000000}$$

$$=\frac{123004600+67325600000+4000+45700000000+13200006}{10000000}$$

$$=\frac{113161808606}{10000000}=11316{\cdot}1808606.$$

(7)

$$\begin{array}{r} 8720{\cdot}0498 \\ {\cdot}0470563 \\ 68{\cdot}57882001 \\ 10300{\cdot}37 \\ \hline 19089{\cdot}04567631 \end{array}$$

$$8720{\cdot}0498 + {\cdot}0470563 + 68{\cdot}57882001 + 10300{\cdot}37$$

$$= \frac{87200498}{10000} + \frac{470563}{10000000} + \frac{6857882001}{100000000} + \frac{1030037}{100}$$

$$= \frac{872004980000 + 4705630 + 6857882001 + 1030037000000}{100000000}$$

$$= \frac{1908904567631}{100000000} = 19089{\cdot}04567631.$$

2. (1)

$$\begin{array}{r} 54{\cdot}3 \\ 7{\cdot}29 \\ 180{\cdot}0046 \\ 187{\cdot} \\ 3{\cdot}024 \\ \hline 431{\cdot}6186 \end{array}$$

(2)

$$\begin{array}{r} 57{\cdot}038 \\ 95{\cdot}00487 \\ 53{\cdot}4690 \\ 2{\cdot}00003 \\ 105{\cdot} \\ \hline 312{\cdot}51190 \end{array}$$

(3)

$$\begin{array}{r} 27{\cdot}5037 \\ {\cdot}042 \\ 342{\cdot} \\ 2{\cdot}1 \\ 1{\cdot}873592 \\ 83{\cdot} \\ \hline 456{\cdot}519292 \end{array}$$

3. (1)

$$\begin{array}{r} 62{\cdot}7 \\ 2{\cdot}030073 \\ 460{\cdot}927 \\ \hline 525{\cdot}657073 \end{array}$$

(2)

$$\begin{array}{r} {\cdot}29 \\ {\cdot}00265 \\ 394{\cdot}1 \\ 8093{\cdot}000061 \\ 3{\cdot}0024 \\ \hline 8490{\cdot}295111 \end{array}$$

(3)

$$\begin{array}{r} 29000{\cdot}092 \\ 230004000{\cdot} \\ 37{\cdot}00154 \\ 99000000{\cdot}000099 \\ 721000{\cdot}00003 \\ \hline 329754037{\cdot}093669 \end{array}$$

SUBTRACTION OF DECIMALS.—Ex. XXI. Page 60.

1.

4·7	14·89	25·358	13·4	34·075
1·4	7·67	14·18	1·27	28·4069
3·3	7·22	11·178	12·13	5·6681

2. (1) $\begin{array}{r} 161{\cdot}06 \\ 42{\cdot}946 \\ \hline 118{\cdot}114 \end{array}$

$$161{\cdot}06 - 42{\cdot}946 = \frac{16106}{100} - \frac{42946}{1000}$$

$$= \frac{161060 - 42946}{1000}$$

$$= \frac{118114}{1000} = 118{\cdot}11.$$

(2) $\begin{array}{r} 28 \\ 17{\cdot}2463 \\ \hline 10{\cdot}7537 \end{array}$

$$28 - 17{\cdot}2463 = \frac{28}{1} - \frac{172463}{10000}$$

$$= \frac{280000 - 172463}{10000}$$

$$= \frac{107537}{10000} = 10{\cdot}7537.$$

(3) $\begin{array}{r} 2420{\cdot}6 \\ 83{\cdot}450932 \\ \hline 2337{\cdot}149068 \end{array}$

$$2420{\cdot}6 - 83{\cdot}450932 = \frac{24206}{10} - \frac{83450932}{1000000}$$

$$= \frac{2420600000 - 83450932}{1000000}$$

$$= \frac{2337149068}{1000000} = 2337{\cdot}149068.$$

(4) $\begin{array}{r} 12{\cdot}0008 \\ 9{\cdot}59 \\ \hline 2{\cdot}4108 \end{array}$

$$12{\cdot}0008 - 9{\cdot}59 = \frac{120008}{10000} - \frac{959}{100}$$

$$= \frac{120008 - 95900}{10000}$$

$$= \frac{24108}{10000} = 2{\cdot}4108.$$

(5) $56{\cdot}904 - 6{\cdot}7996 + 12{\cdot}103 - 37{\cdot}222$
$= 50{\cdot}1044 + 12{\cdot}103 - 37{\cdot}222$
$= 62{\cdot}2074 - 37{\cdot}222$
$= 24{\cdot}9854.$

$$56{\cdot}904 - 6{\cdot}7996 + 12{\cdot}103 - 37{\cdot}222$$
$$= \frac{56904}{1000} - \frac{67996}{10000} + \frac{12103}{1000} - \frac{37222}{1000}$$
$$= \frac{569040 - 67996 + 121030 - 372220}{10000}$$
$$= \frac{(569040 + 121030) - (67996 + 372220)}{10000}$$
$$= \frac{690070 - 440216}{10000}$$
$$= \frac{249854}{10000} = 24{\cdot}9854.$$

(6) $60{\cdot}7 - ({\cdot}007 - {\cdot}00695437) + 70{\cdot}25 - 25{\cdot}007$
$= 60{\cdot}7 - {\cdot}00004563 + 70{\cdot}25 - 25{\cdot}007$
$= 60{\cdot}69995437 + 70{\cdot}25 - 25{\cdot}007$
$= 130{\cdot}94995437 - 25{\cdot}007$
$= 105{\cdot}94295437.$

$$60{\cdot}7 - ({\cdot}007 - {\cdot}00695437) + 70{\cdot}25 - 25{\cdot}007$$
$$= \frac{607}{10} - \left(\frac{7}{1000} - \frac{695437}{100000000}\right) + \frac{7025}{100} - \frac{25007}{1000}$$
$$= \frac{6070000000}{100000000} - \left(\frac{700000}{100000000} - \frac{695437}{100000000}\right) + \frac{7025000000}{100000000} - \frac{2500700000}{100000000}$$
$$= \frac{6070000000 - 4563 + 7025000000 - 2500700000}{100000000}$$
$$= \frac{6069995437 + 7025000000 - 2500700000}{100000000}$$
$$= \frac{13094995437 - 2500700000}{100000000}$$
$$= \frac{10594295437}{100000000} = 105{\cdot}94295437.$$

3.

6346	4·2	·00005
·6346	·0042	·0000005
6345·3654	4·1958	·0000495

4.

·01	2·9	99
·0001	·092	9·00000099
·0099	2·808	89·99999901

5.

25·7	58
8·389	57·145
23·056	·855
57·145	

$$\text{the fraction required} = \frac{855}{1000} = \frac{171}{200}.$$

6. (1st + 2nd + 3rd) class contain (·24 + ·36 + ·18) or ·78 of the whole no., or $\frac{78}{100}$ of the whole no.;

$\therefore$ 4th class contains whole no. $- \frac{78}{100}$ of whole no.;

$\therefore$ ..... $\left(1 - \frac{78}{100}\right)$ or $\frac{22}{100}$ of the whole no.,

or $\frac{22}{100}$ of 300, or 66.

MULTIPLICATION OF DECIMALS.

Ex. XXII. Page 61.

1. (1)

24·5
9
220·5

$$24{\cdot}5 \times 9 = \frac{245}{10} \times 9 = \frac{2205}{10} = 220{\cdot}5.$$

7·2
·4
2·88

$$7{\cdot}2 \times {\cdot}4 = \frac{72}{10} \times \frac{4}{10} = \frac{288}{100} = 2{\cdot}88.$$

·48
36
288
144
·1728

$$\cdot 48 \times \cdot 36 = \frac{48}{100} \times \frac{36}{100} = \frac{1728}{10000} = \cdot 1728.$$

4·59
·0003
·001377

$$4 \cdot 59 \times \cdot 0003 = \frac{459}{100} \times \frac{3}{10000} = \frac{1377}{1000000} = \cdot 001377.$$

2) ·034
·0008
·0000272

$$\cdot 034 \times \cdot 0008 = \frac{34}{1000} \times \frac{8}{10000} = \frac{272}{10000000} = \cdot 0000272.$$

7·45
2·7504
2980
3725
5215
1490
20·490480
=20·49048

$$7 \cdot 45 \times 2 \cdot 7504 = \frac{745}{100} \times \frac{27504}{10000} = \frac{20490480}{1000000} = 20 \cdot 49048.$$

42·200
2·00400
16880000
844
84·56880000
=84·5688

$$42 \cdot 200 \times 2 \cdot 00400 = \frac{422}{10} \times \frac{2004}{1000} = \frac{845688}{10000} = 84 \cdot 5688.$$

(3) 79·004
·00473
237012
553028
316016
·37368892

$$79 \cdot 004 \times \cdot 00473 = \frac{79004}{1000} \times \frac{473}{100000} = \frac{37368892}{100000000} = \cdot 37368892.$$

412·5384
1·00003
12376152
4125384
412·550776152

$412\cdot5384+1\cdot00003$
$=\frac{4125384}{10000}\times\frac{100003}{100000}$
$=\frac{412550776152}{1000000000}$
$=412\cdot550776152.$

40·86
·0000293
12258
36774
8172
·001197198

$40\cdot86\times\cdot0000293$
$=\frac{4086}{100}\times\frac{293}{10000000}$
$=\frac{1197198}{1000000000}$
$=\cdot001197198.$

(4)

·000756
6·75
3780
5292
4536
·00510300
$=\cdot005103$

$\cdot000756\times6\cdot75=\frac{756}{1000000}\times\frac{675}{100}$
$=\frac{5103}{1000000}$
$=\cdot005103.$

·000002897
3020
57940
8691
·008748940
$=\cdot00874894$

$\cdot000002897\times3020$
$=\frac{2897}{1000000000}\times\frac{3020}{1}$
$=\frac{874894}{100000000}$
$=\cdot00874894.$

·19378
·1938
155024
58134
174402
19378
·037554564

$\cdot19378\times\cdot1938=\frac{19378}{100000}\times\frac{1938}{10000}$
$=\frac{37554564}{1000000000}$
$=\cdot037554564.$

2.

4·2
·042
84
168
·1764
420
35280
7056
74·0880
·0042
1481760
296352
·31116960
= ·3111696

$$4\cdot2 \times \cdot042 \times 420 \times \cdot0042 = \frac{42}{10} \times \frac{42}{1000} \times \frac{420}{1} \times \frac{42}{10000} = \frac{3111696}{10000000} = \cdot3111696.$$

2·07004
·07
·1449028
500
72·4514000
·0001
·00724514

$$2\cdot07004 \times \cdot07 \times 500 \times \cdot0001 = \frac{207004}{100000} \times \frac{7}{100} \times \frac{500}{1} \times \frac{1}{10000} = \frac{724514}{100000000} = \cdot00724514.$$

3·05
·25
1525
610
·7625
·32
15250
22875
·244000
·231
244
732
488
·056364

$$3\cdot05 \times \cdot25 \times \cdot32 \times \cdot231 = \frac{305}{100} \times \frac{25}{100} \times \frac{32}{100} \times \frac{231}{1000} = \frac{56364}{1000000} = \cdot056364.$$

3.

7925·648 mi.	883345·172192 mi.
111·454	3·14159
31702592	7950106549728
39628240	4416725860960
31702592	883345172192
7925648	3533380688768
7925648	883345172192
7925648	2650035516576
883345·172192 mi.	2775103·35950666528 mi.

DIVISION OF DECIMALS.—Ex. XXIII. Page 65.

1. (1) $38\overline{)15\cdot96}\,(\cdot42$ $\quad 152$ $\quad 76$ $\quad 76$

$$\therefore 15\cdot96\div38=\frac{1596}{100}\times\frac{1}{38}$$
$$=\frac{1596}{38}\times\frac{1}{100}$$
$$=\frac{42}{100}=\cdot42.$$

$3\cdot8\overline{)1\cdot596}\,(\cdot42$

$$1\cdot596\div3\cdot8=\frac{1596}{1000}\times\frac{10}{38}$$
$$=\frac{1596}{38}\times\frac{10}{1000}$$
$$=\frac{42}{100}=\cdot42.$$

$\cdot038\overline{)1\cdot596}\,(42$

$$1\cdot596\div\cdot038=\frac{1596}{1000}\times\frac{1000}{38}$$
$$=\frac{1596}{38}=42.$$

$38\overline{)1596\cdot00}\,(4200$

$$1596\div38=\frac{1596}{1}\times\frac{100}{38}$$
$$=\frac{1596}{38}\times100$$
$$=42\times100=4200.$$

(2) ·53) 17·1031 (32·27
159
120
106
143
106
371
371

$$17\cdot1031 \div \cdot53 = \frac{171031}{10000} \times \frac{100}{53}$$
$$= \frac{171031}{53} \times \frac{1}{100}$$
$$= \frac{3227}{100} = 32\cdot27.$$

·0053) 17·1031 (3227

$$17\cdot1031 \div \cdot0053 = \frac{171031}{10000} \times \frac{10000}{53}$$
$$= \frac{171031}{53} = 3227.$$

53) 17·1031 (·3227

$$17\cdot1031 \div 53 = \frac{171031}{10000} \times \frac{1}{53}$$
$$= \frac{171031}{53} \times \frac{1}{10000}$$
$$= \frac{3227}{10000} = \cdot3227.$$

·000053) 17·103100 (322700

$$17\cdot1031 \div \cdot000053$$
$$= \frac{171031}{10000} \times \frac{1000000}{53}$$
$$= \frac{171031}{53} \times 100$$
$$= 3227 \times 100 = 322700.$$

(3) 4·07) 3·72812 (·916
3663
651
407
2442
2442

$$3\cdot72812 \div 4\cdot07$$
$$= \frac{372812}{100000} \times \frac{100}{407}$$
$$= \frac{372812}{407} \times \frac{1}{1000}$$
$$= \frac{916}{1000} = \cdot916.$$

$$\cdot 407 \overline{)\, 372\cdot 812\,(\,916} \qquad 372\cdot 812 \div \cdot 407 = \frac{372812}{1000} \times \frac{1000}{407}$$

$$= \frac{372812}{407} = 916.$$

$$\cdot 000407 \overline{)\, 37281\cdot 200000\,(\,91600000}$$

$$37281\cdot 2 \div \cdot 000407 = \frac{372812}{10} \times \frac{1000000}{407}$$

$$= \frac{372812}{407} \times 100000$$

$$= 916 \times 100000 = 91600000.$$

(4) $1\cdot 25 \overline{)\, 1\cdot 000\,(\,\cdot 8}$ $\quad 1000$

$$1 \div 1\cdot 25 = 1 \times \frac{100}{125} = \frac{1000}{125} \times \frac{1}{10}$$

$$= \frac{8}{10} = \cdot 8.$$

$\cdot 005 \overline{)\, \cdot 0120\,(\,2\cdot 4}$ $\quad 10$, 20, 20

$$\cdot 012 \div \cdot 005 = \frac{12}{1000} \times \frac{1000}{5} = \frac{120}{5} \times \frac{1}{10}$$

$$= \frac{24}{10} = 2\cdot 4.$$

$\cdot 0002 \overline{)\, 2\cdot 0000\,(\,10000}$

$$2 \div \cdot 0002 = \frac{2}{1} \times \frac{10000}{2}$$

$$= \frac{2}{2} \times 10000$$

$$= 1 \times 10000$$

$$= 10000.$$

$$10000000 \overline{)\, 703\cdot 40000000\,(\,\cdot 00007034}$$

$$703\cdot 4 \div 10000000 = \frac{7034}{10} \times \frac{1}{10000000} = \frac{7034}{100000000}$$

$$= \cdot 00007034.$$

(5) $7{\cdot}85\overline{)36{\cdot}25130(4{\cdot}618}$

3140

4851

4710

1413

785

6280

6280

$36{\cdot}2513 \div 7{\cdot}85$

$= \frac{362513}{10000} \times \frac{100}{785}$

$= \frac{3625130}{785} \times \frac{1}{1000}$

$= \frac{4618}{1000} = 4{\cdot}618.$

$562{\cdot}73\overline{)\cdot0450184(\cdot00008}$

450184

$\cdot0450184 \div 562{\cdot}73$

$= \frac{450184}{10000000} \times \frac{100}{56273}$

$= \frac{450184}{56273} \times \frac{1}{100000}$

$= \frac{8}{100000} = \cdot00008.$

$2{\cdot}00099\overline{)218051{\cdot}081884(108971{\cdot}6}$

200099

1795208

1600792

1944161

1800891

1432708

1400693

320158

200099

1200594

1200594

$218051{\cdot}081884 \div 2{\cdot}00099$

$= \frac{218051081884}{1000000} \times \frac{100000}{200099}$

$= \frac{218051081884}{200099} \times \frac{1}{10}$

$= \frac{1089716}{10} = 108971{\cdot}6.$

(6) $6{\cdot}056\overline{)\cdot055757592(\cdot009207}$

54504

12535

12112

42392

42392

$\cdot055757592 \div 6{\cdot}056$

$= \frac{55757592}{1000000000} \times \frac{1000}{6056}$

$= \frac{55757592}{6056} \times \frac{1}{1000000}$

$= \frac{9207}{1000000} = \cdot009207.$

3020) 8·748940 (·002897
6040
27089
24160
29294
27180
21140
21140

$$8\cdot74894 \div 3020 = \frac{874894}{100000} \times \frac{1}{3020} = \frac{874894}{302} \times \frac{1}{1000000} = \frac{2897}{1000000} = \cdot002897.$$

·0302) 8·74894 (289·7

$$8\cdot74894 \div \cdot0302 = \frac{874894}{100000} \times \frac{10000}{302} = \frac{874894}{302} \times \frac{1}{10} = \frac{2897}{10} = 289\cdot7.$$

(7) 710·1) ·64619391141 (·0009100041
63909
7103
7101
29114
28404
7101
7101

$$\cdot64619391141 \div 710\cdot1 = \frac{64619391141}{100000000000} \times \frac{10}{7101} = \frac{64619391141}{7101} \times \frac{1}{10000000000} = \frac{9100041}{10000000000} = \cdot0009100041.$$

·00693) 2547052·20000 (367540000
2079
4680
4158
5225
4851
3742
3465
2772
2772

$$2547052\cdot2 \div \cdot00693 = \frac{25470522}{10} \times \frac{100000}{693} = \frac{25470522}{693} \times \frac{100000}{10} = 36754 \times 10000 = 367540000.$$

693) 2547052·2 (3675·4

$$2547052\cdot2 \div 693$$
$$= \frac{25470522}{10} \times \frac{1}{693}$$
$$= \frac{25470522}{693} \times \frac{1}{10}$$
$$= \frac{36754}{10} = 3675\cdot4.$$

(8) ·0089) 65·06612089 (7310·8001

623
276
267
96
89
712
712
089
89

$$65\cdot06612089 \div \cdot0089$$
$$= \frac{6506612089}{100000000} \times \frac{10000}{89}$$
$$= \frac{6506612089}{89} \times \frac{10000}{100000000}$$
$$= \frac{73108001}{10000} = 7310\cdot8001.$$

8·9) 65·06612089 (7·3108001

$$65\cdot06612089 \div 8\cdot9$$
$$= \frac{6506612089}{100000000} \times \frac{10}{89}$$
$$= \frac{6506612089}{89} \times \frac{1}{10000000}$$
$$= \frac{73108001}{10000000}$$
$$= 7\cdot3108001$$

89000) 65·06612089000 (·00073108001

$$65\cdot06612089 \div 89000$$
$$= \frac{6506612089}{100000000} \times \frac{1}{89000}$$
$$= \frac{6506612089}{89} \times \frac{1}{10000000000}$$
$$= \frac{73108001}{100000000000}$$
$$= \cdot00073108001.$$

(9) $\cdot001 \div (1 \times \cdot01 \times 100) = \frac{1}{1000} \div \left(1 \times \frac{1}{100} \times 100\right) = \frac{1}{1000} = \cdot001;$

$$\cdot20736 \div (1\cdot2 \times \cdot012 \times 120) = \frac{20736}{100000} \div \left(\frac{12}{10} \times \frac{12}{1000} \times \frac{120}{1}\right)$$

$$= \frac{20736}{100000} \times \frac{10}{12} \times \frac{1000}{12} \times \frac{1}{120}$$

$$= \frac{20736}{12 \times 12 \times 12} \times \frac{1}{100}$$

$$= \frac{12}{100} = \cdot12.$$

$$\begin{array}{r} 76\cdot8 \\ \cdot0987 \\ \hline 5376 \\ 6144 \\ 6912 \\ \hline 7\cdot58016 \end{array} \qquad \begin{array}{r|l} 7\cdot58016 & 98\cdot8452864 \ (13\cdot04 \\ & 758016 \\ & \hline & 2304368 \\ & 2274048 \\ & \hline & 3032064 \\ & 3032064 \\ & \hline \end{array}$$

$$98\cdot8452864 \div (76\cdot8 \times \cdot0987)$$

$$= \frac{988452864}{10000000} \times \frac{10}{768} \times \frac{10000}{987}$$

$$= \frac{988452864}{758016} \times \frac{1}{100}$$

$$= \frac{1304}{100} = 13\cdot04.$$

(10) $1\cdot4 \times \cdot015 = \cdot021;$

$$\begin{array}{r|l} \cdot00014 & \cdot02100 \ (150 \\ & 14 \\ & \hline & 70 \\ & 70 \\ & \hline \end{array}$$

$$1\cdot4 \times \cdot015 \div \cdot00014$$

$$= \frac{14}{10} \times \frac{15}{1000} \times \frac{100000}{14} = 15 \times 10 = 150;$$

$$\begin{aligned}&143{\cdot}507702 \div (107{\cdot}8 + 6{\cdot}541 - 31{\cdot}96)\\ &= 143{\cdot}507702 \div (114{\cdot}341 - 31{\cdot}96)\\ &= 143{\cdot}507702 \div 82{\cdot}381;\end{aligned}$$

$$\begin{array}{r|l} 82{\cdot}381 & 143{\cdot}507702 \ (1{\cdot}742 \\ & \underline{82381} \\ & 611267 \\ & \underline{576667} \\ & 346000 \\ & \underline{329524} \\ & 164762 \\ & \underline{164762} \end{array}$$

$$\begin{aligned}&143{\cdot}507702 \div (107{\cdot}8 + 6{\cdot}541 - 31{\cdot}96)\\ &= \frac{143507702}{1000000} \div \left(\frac{1078}{10} + \frac{6541}{1000} - \frac{3196}{100}\right)\\ &= \frac{143507702}{1000000} \div \frac{107800 + 6541 - 31960}{1000}\\ &= \frac{143507702}{1000000} \times \frac{1000}{82381}\\ &= \frac{143507702}{82381} \times \frac{1000}{1000000} = \frac{1742}{1000} = 1{\cdot}742.\end{aligned}$$

2. (1)

$$\begin{array}{r|l} 3{\cdot}81 & 3496{\cdot}18000 \ (917{\cdot}632 \\ & \underline{3429} \\ & 671 \\ & \underline{381} \\ & 2908 \\ & \underline{2667} \\ & 2410 \\ & \underline{2286} \\ & 1240 \\ & \underline{1143} \\ & 970 \\ & \underline{762} \\ & 208 \end{array}$$

$$\begin{aligned}&3496{\cdot}18 \div 3{\cdot}81\\ &= \frac{349618}{100} \times \frac{100}{381}\\ &= \frac{349618000}{381} \times \frac{1}{1000}\\ &= \frac{917632\ldots}{1000} = 917{\cdot}632\ldots\end{aligned}$$

·023965) 1·916065200 (79·952
167755
238515
215685
228302
215685
126170
119825
63450
47930
15520

$$1{\cdot}9160652 \div {\cdot}023965 = \frac{19160652}{10000000} \times \frac{1000000}{23965} = \frac{1916065200}{23965} \times \frac{1}{1000} = \frac{79952\ldots}{1000} = 79{\cdot}952\ldots$$

5307) 3495·200 (·658
31842
31100
26535
45650
42456
3194

$$3495{\cdot}2 \div 5307 = \frac{34952}{10} \times \frac{1}{5307} = \frac{34952}{5307} \times \frac{1}{10} = \frac{3495200}{5307} \times \frac{1}{1000} = \frac{658\ldots}{1000} = {\cdot}658\ldots$$

(2) 3936·2) 84·5000 (·021
78724
57760
39362
18398

$$84{\cdot}5 \div 3936{\cdot}2 = \frac{845}{10} \times \frac{10}{39362} = \frac{845000}{39362} \times \frac{1}{1000} = \frac{21\ldots}{1000} = {\cdot}021.$$

28·713) 37·520000 (1·306
28713
88070
86139
193100
172278
20822

$$37{\cdot}52 \div 28{\cdot}713 = \frac{3752}{100} \times \frac{1000}{28713} = \frac{37520000}{28713} \times \frac{1}{1000} = \frac{1306\ldots}{1000} = 1{\cdot}306.$$

$2{\cdot}14\,)\,{\cdot}00340\,(\,{\cdot}001$

214

$\overline{116}$

$$\cdot0034 \div 2{\cdot}14 = \frac{34}{10000} \times \frac{100}{214}$$

$$= \frac{340}{214} \times \frac{1}{1000}$$

$$= \frac{1\ldots}{1000} = {\cdot}001\ldots$$

3. No. of days $= 63{\cdot}25 \div 2{\cdot}3$;

$2{\cdot}3\,)\,63{\cdot}25\,(27{\cdot}5$

46

$\overline{172}$

161

$\overline{115}$

115

$\therefore$ No. of days $= 27{\cdot}5 = 27\frac{5}{10} = 27\frac{1}{2}$.

4. $1{\cdot}3569\,)\,{\cdot}0498552198\,(\,{\cdot}036742$

40707

$\overline{91482}$

81414

$\overline{100681}$

94983

$\overline{56989}$

54276

$\overline{27138}$

27138

the other no. $= {\cdot}036742$.

5. $1048{\cdot}69\,)\,354936{\cdot}00000\,(338{\cdot}456$

314607

$\overline{403290}$

314607

$\overline{886830}$

838952

$\overline{478780}$

419476

$\overline{593040}$

524345

$\overline{686950}$

629214

$\overline{57736}$

6. The average age of the remaining children

$$= \frac{10{\cdot}515 \times 50 - (13{\cdot}5 \times 2 + 12{\cdot}375 \times 8 + 11 \times 17)}{23} \text{ yrs.}$$

$$= \frac{525{\cdot}75 - 313}{23} \text{ yrs.}$$

$$= \frac{212{\cdot}75}{23} \text{ yrs.} = 9{\cdot}25 \text{ yrs.} = 9\tfrac{1}{4} \text{ yrs.}$$

7. No. of children who attended on

Monday	$= 67 + 64$
Tuesday	$= 60 + 59$
Wednesday	$= 65 + 59$
Thursday	$= 68 + 63$
Friday	$= 62 + 60$

$\therefore$ the total no. of children who attended on these 10 occasions $= 627$;

$$\therefore \text{ average attendance} = \frac{627}{10} = 62{\cdot}7.$$

VULGAR FRACTIONS EXPRESSED AS DECIMALS.

Ex. XXIV. Page 68.

(1) $4 \overline{)3{\cdot}00}\ {\cdot}75$ $\quad 2 \overline{)1{\cdot}0}\ {\cdot}5$ $\quad 4 \overline{)5{\cdot}00}\ 1{\cdot}25$ $\quad 5 \overline{)3{\cdot}0}\ {\cdot}6$

$\therefore\ 2\frac{3}{5} = 2{\cdot}6;$

$16 \begin{cases} 4 \overline{)7{\cdot}00} \\ 4 \overline{)1{\cdot}7500}\ {\cdot}4375 \end{cases}$ $\quad \frac{11}{20} = \frac{55}{100} = {\cdot}55;\ \ 7\frac{19}{25} = 7\frac{76}{100} = 7{\cdot}76.$

$40 \begin{cases} 4 \\ 10 \overline{)13{\cdot}00} \\ \overline{)3{\cdot}250}\ {\cdot}325 \end{cases}$ $\qquad 32 \begin{cases} 4 \overline{)7{\cdot}00} \\ 8 \overline{)1{\cdot}75000}\ {\cdot}21875 \end{cases}$

$\therefore\ 8\frac{7}{32} = 8{\cdot}21875.$

(2) $128\begin{cases}4 & 37 \\ 8 & 9{\cdot}25000 \\ 4 & 1{\cdot}1562500 \\ & \cdot 2890625\end{cases}$ $\therefore\ 17\frac{37}{128}=17{\cdot}2890625;$

$$\frac{4}{125}=\frac{32}{1000}=\cdot 032;$$

$$\frac{570}{400}=\frac{57}{40};\quad 40\begin{cases}4 & 57 \\ 10 & 14{\cdot}25 \\ & 1{\cdot}425\end{cases}$$

$$1024\begin{cases}8 & 5{\cdot}000 \\ 8 & \cdot 625000 \\ 8 & \cdot 078125000 \\ 2 & \cdot 0097656250 \\ & \cdot 0048828125\end{cases}$$

$\therefore\ 100\frac{5}{1024}=100{\cdot}0048828125;$

$$\frac{729}{12150}=\frac{3}{50}=\frac{6}{100}=\cdot 06;$$

$$\frac{241}{15424}=\frac{1}{64},$$

$64\begin{cases}8 & 1{\cdot}000 \\ 8 & \cdot 125 \\ & \cdot 015625\end{cases}$ $\therefore\ 23\frac{241}{15424}=23{\cdot}015625.$

(3) $\frac{2}{5}+\frac{5}{8}+\frac{1}{16}-1\frac{1}{40}=\cdot 4+\cdot 625+\cdot 0625-1{\cdot}025$

$=1{\cdot}0875-1{\cdot}025=\cdot 0625;$

$1\frac{3}{4}-\frac{7}{8}$ of $\frac{18}{28}=1\frac{3}{4}-\frac{9}{16}=1{\cdot}75-\cdot 5625=1{\cdot}1875;$

$\frac{5}{6}$ of $\frac{12}{25}+5\frac{1}{2}=\frac{2}{5}+5\frac{1}{2}=\cdot 4+5{\cdot}5=5{\cdot}9.$

(4) $3\frac{3}{4}$ of $2\frac{1}{2} = 3{\cdot}75$ of $2{\cdot}5 = 9{\cdot}375$;

$5\frac{1}{2}$ of $5\frac{1}{4}$ of $5\frac{1}{2} = 5{\cdot}5 \times 5{\cdot}25 \times 5{\cdot}125 = 147{\cdot}984375$;

$$7\frac{37}{1600} \text{ of } 15\frac{9}{200} = 7\frac{{\cdot}37}{16} \text{ of } 15\frac{45}{1000} = 7\frac{{\cdot}0925}{4} \text{ of } 15{\cdot}045$$
$$= 7{\cdot}023125 \times 15{\cdot}045$$
$$= 105{\cdot}662915625.$$

(5) $3\frac{7}{8} - 2\frac{1}{5} + 4\frac{9}{20} = 3{\cdot}875 - 2{\cdot}2 + 4{\cdot}45$

$$= 8{\cdot}325 - 2{\cdot}2 = 6{\cdot}125;$$

$$15\frac{19}{640} + \frac{3}{{\cdot}075} \text{ of } \frac{7}{5} \text{ of } 2\tfrac{1}{2} = 15\frac{2{\cdot}375}{80} + \frac{3000}{75} \text{ of } \frac{7}{5} \text{ of } \frac{5}{2}$$
$$= 15{\cdot}0296875 + 140$$
$$= 155{\cdot}0296875.$$

CIRCULATING DECIMALS.

Ex. XXV. Page 71.

1. (1)

$$3 \overline{)2{\cdot}00} \quad {\cdot}66\ldots$$
$$= {\cdot}\dot{6};$$

$$9 \overline{)1{\cdot}00} \quad {\cdot}11\ldots$$
$$= {\cdot}\dot{1};$$

$$7 \overline{)6{\cdot}0000000} \quad {\cdot}8571428\ldots$$
$$= {\cdot}\dot{8}57142\dot{8};$$

$$12 \overline{)7{\cdot}00000} \quad {\cdot}58333\ldots$$
$$= {\cdot}58\dot{3};$$

$$15 \begin{cases} 5 \overline{)11{\cdot}0} \\ 3 \overline{)2{\cdot}2000} \end{cases} \quad {\cdot}7333\ldots$$
$$= {\cdot}7\dot{3};$$

$$99 \begin{cases} 9 \overline{)4{\cdot}000} \\ 11 \overline{)\cdot444\ldots} \end{cases} \quad {\cdot}0404\ldots$$
$$= {\cdot}0\dot{4};$$

$$13 \,|\, \overline{3\cdot000000}$$
$$\overline{\cdot2307692\ldots}$$

$$= \cdot\dot{2}30769\dot{2}.$$

(2) $$81 \begin{cases} 9 \,|\, \overline{3\cdot0} \\ 9 \,|\, \overline{\cdot3333\ldots} \end{cases}$$
$$\overline{\cdot0370\ldots}$$

$\therefore 6\frac{3}{81} = 6\cdot\dot{0}3\dot{7}$;

$$37 \overline{)\,5\cdot0\,(135}$$
$$\begin{array}{r} 37 \\ \hline 130 \\ 111 \\ \hline 190 \\ 185 \\ \hline 5 \end{array}$$

$\therefore 7\frac{5}{37} = 7\cdot\dot{1}3\dot{5}$;

$$9009 \begin{cases} 9 \,|\, \overline{4\cdot0\ldots} \\ 1001 \overline{)\,\cdot44444\ldots\,(\cdot000444} \end{cases}$$
$$\begin{array}{r} 4004 \\ \hline 4404 \\ 4004 \\ \hline 4004 \\ 4004 \\ \hline 4 \end{array}$$

$$\therefore \frac{4}{9009} = \cdot\dot{0}00444\dot{4};$$

$$44 \begin{cases} 4 \,|\, \overline{7\cdot0} \\ 11 \,|\, \overline{1\cdot75} \end{cases}$$
$$\overline{\cdot159090\ldots}$$

$\therefore 100\frac{7}{44} = 100\cdot15\dot{9}\dot{0}$;

$$
\begin{array}{r|l}
17 & 15{\cdot}0 \\
 & 136 \\
\hline
 & 140 \\
 & 136 \\
\hline
 & 40 \\
 & 34 \\
\hline
 & 60 \\
 & 51 \\
\hline
 & 90 \\
 & 85 \\
\hline
 & 50 \\
 & 34 \\
\hline
 & 160 \\
 & 153 \\
\hline
 & 70 \\
 & 68 \\
\hline
 & 20 \\
 & 17 \\
\hline
 & 30 \\
 & 17 \\
\hline
 & 130 \\
 & 119 \\
\hline
 & 110 \\
 & 102 \\
\hline
 & 80 \\
 & 68 \\
\hline
 & 120 \\
 & 119 \\
\hline
 & 100 \\
 & 86 \\
\hline
 & 15
\end{array}
\quad \cdot\cdot\ 0{\cdot}8823529411764705
$$

$$\therefore\ 2\tfrac{15}{17} = 2{\cdot}\dot{8}23529411764705\dot{8}.$$

2. (1) $\cdot\dot{2} = \frac{2}{9}$; $\cdot\dot{0}\dot{5} = \frac{5}{99}$; $\cdot\dot{1}\dot{8} = \frac{18}{99} = \frac{2}{11}$;

$$\cdot 1\dot{5}\dot{6} = \frac{156-1}{990} = \frac{155}{990} = \frac{31}{198};$$

$$\cdot 027\dot{0}2\dot{7} = \frac{27}{999} = \frac{3}{111} = \frac{1}{37};$$

$$\cdot\dot{2}8571\dot{4}=\frac{285714}{999999}=\frac{142857\times 2}{142857\times 7}=\frac{2}{7}.$$

(2) $\cdot 5\dot{6}\dot{6}=\frac{56-5}{90}=\frac{51}{90}=\frac{17}{30}$;

$$\cdot 7\dot{4}\dot{3}=\frac{743-7}{990}=\frac{736}{990}=\frac{368}{495};$$

$$\cdot\dot{2}0\dot{2}3\dot{5}=\frac{20235-2}{99990}=\frac{20233}{99990};$$

$$19\cdot 30\dot{5}=19\frac{305-30}{900}=19\frac{275}{900}=19\frac{11}{36};$$

$$20\cdot 029\dot{1}\dot{6}=20\frac{2916-291}{90000}=20\frac{2625}{90000}=20\frac{375\times 7}{375\times 240}=20\frac{7}{240}.$$

3. (1)

4·33333333	
16·45454546	
293·90909090	
75·73523523	
390·43220492	

Ans. 390·432204.

(2)

3·23333333	
26·79679680	
503·81281281	
7·41341341	
541·25635635	

Ans. 541·256356.

(3)

3·85646464	
2·03877778	
1·81768686	

Ans. 1·817686.

(4)

52·86868687	
8·37235723	
44·49632964	

Ans. 44·496329.

4. (1) $7\cdot\dot{6}\times 5\cdot\dot{3}=7\frac{3}{4}\times 5\frac{1}{3}=\frac{23}{3}\times\frac{16}{3}=\frac{368}{9}=40\cdot 88=40\cdot\dot{8}$;

$$\cdot\dot{3}5\dot{1}\times\cdot 7\dot{3}\dot{6}=\frac{351}{999}\times\frac{736-7}{990}=\frac{13}{37}\times\frac{729}{990}=\frac{13}{37}\times\frac{81}{110}$$
$$=\frac{1053}{4070}=\cdot 258\ldots;$$

$$\cdot 1\dot{3}\times\cdot 2\times\cdot\dot{4}=\frac{13-1}{90}\times\frac{2}{10}\times\frac{4}{9}=\frac{6}{45}\times\frac{1}{5}\times\frac{4}{9}=\frac{8}{15\times 5\times 9}$$
$$=\frac{8}{5\times 5\times 3\times 3\times 3};$$

$$\begin{array}{r|l} 5 & 8 \\ 5 & 1{\cdot}6 \\ 3 & {\cdot}32 \\ 3 & {\cdot}10666 \\ 3 & {\cdot}0355555 \\ & {\cdot}0118518\ldots \end{array}$$

$\therefore\ 1\dot{3} \times {\cdot}2 \times {\cdot}\dot{1} = {\cdot}01\dot{1}8\dot{5}.$

(2) $6{\cdot}\dot{7} \div 2{\cdot}\dot{6} = 6\frac{7}{9} \div 2\frac{2}{3} = \frac{61}{9} \times \frac{3}{8} = \frac{61}{3 \times 8}$;

$$\begin{array}{r|l} 3 & 61 \\ 8 & \overline{20{\cdot}3333} \\ & 2{\cdot}5416\dot{6} \end{array}$$

$\therefore$ Ans. $= 2{\cdot}5416\dot{6}.$

$$\cdot 26\dot{2}\dot{7} \div 1{\cdot}926\dot{6} = \frac{2627 - 26}{9900} \div 1\frac{926 - 92}{900}$$

$$= \frac{2601}{9900} \div 1\frac{834}{900}$$

$$= \frac{289}{1100} \times \frac{900}{1734} = \frac{2601}{11 \times 1734} = \frac{867}{11 \times 578}$$

$$= \frac{78{\cdot}818181\ldots}{578} = {\cdot}1\dot{3}\dot{6};$$

$${\cdot}8\dot{7}\dot{1} \div 5 = \frac{871 - 8}{990} \times \frac{1}{5} = \frac{368}{990 \times 5} = \frac{73{\cdot}6}{990} = \frac{7{\cdot}36}{99} = {\cdot}07\dot{4}\dot{3};$$

$$42{\cdot}0463 \div 1{\cdot}\dot{3}\dot{6} = 42{\cdot}0463 \div 1\tfrac{33}{99} = \frac{42{\cdot}0463 \times 11}{15}$$

$$= \frac{462{\cdot}5093}{15} = \frac{92{\cdot}50186}{3} = 30{\cdot}8339\dot{5}\dot{3}.$$

REDUCTION OF DECIMALS.—Ex. XXVI. Page 74.

1. (1)

£ ·25 × 20 = 5·00*s.* Ans. 5*s.*

£ ·025 × 20 = ·500*s.* × 12 = 6·000*d.* Ans. 6*d.*

£ ·675 × 20 = 13·500*s.* × 12 = 6·000*d.* Ans. 13*s.* 6*d.*

£ ·39375 × 20 = 7·87500*s.* × 12 = 10·50000*d.* × 4 = 2·00000*q.* Ans. 7*s.* $10\frac{1}{2}d.$

(2)

£ ·365625 × 20 = 7·312500*s.* × 12 = 3·750000*d.* × 4 = 3·000000*q.* Ans. 7*s.* $3\frac{3}{4}d.$

£ ·003125 × 20 = ·062500*s.* × 12 = ·750000*d.* × 4 = 3·000000*q.* Ans. $\frac{3}{4}d.$

£ ·8756 × 20 = 17·5120*s.* × 12 = 6·1440*d.* Ans. 17*s.* $6\frac{144}{1000}d.$ = 17*s.* $6\frac{18}{125}d.$

(3)

£ 7·75 × 20 = 15·00*s.* Ans. £7. 15*s.*

·325 of £5 × 5 = £1·625 × 20 = 12·500*s.* × 12 = 6·000*d.* Ans. £1. 12*s.* 6*d.*

£ 3·240625 × 20 = 4·812500*s.* × 12 = 9·750000*d.* × 4 = 3·000000*q.* Ans. £3. 4*s.* $9\frac{3}{4}d.$

(4)

guineas ·375 × 21 = 375 + 750 = 7·875*s.* × 12 = 10·500*d.* × 4 = 2·000*q.* Ans. 7*s.* $10\frac{1}{2}d.$

guineas 2·46875 × 21 = 46875 + 93750 = 9·84375*s.* × 12 = 10·12500*d.* Ans. 2gs. 9*s.* $10\frac{125}{1000}d.$ or £2. 11*s.* $10\frac{1}{8}d.$

1·37 of 5*s.* × 5 = 6·85*s.* × 12 = 10·20*d.* Ans. 6*s.* $10\frac{1}{5}d.$

(5)

lb. Troy	sc.	mi.
·765625	·875	·90625
12	4	8
9·187500 oz.	3·500 ro.	7·25000 fur.
20	40	40
3·750000 dwts.	20·000 po.	10·00000 po.
24		
3000000	Ans. 3 ro. 20 po.	Ans. 7 fur. 10 po.
1500000		
18·000000 grs.		

Ans. 9 oz. 3 dwts. 18 grs.

(6)

tons	·815 of 15*s.*6*d.*
5·01875	31
20	815
·37500 cwt.	2445
4	25·265 sixpences
1·50000 qr.	6
28	1·590*d.*
14·0 lbs.	4
	2·360*q.*

Ans. 5 tons 1 qr. 14 lbs.

Ans. 12*s.* 7½*d.* $\frac{9}{25}$*q.*

·007875 of £1000
1000
£7·875
20
17·500*s.*
12
6·0*d.*

Ans. £7. 17*s.* 6*d.*

(7)

ac.
2·35078125
4
1·40312500 ro.
40
16·125000 po.
30¼
8750
3125
3·78125 yds.
9
7·03125 ft.
144
12500
12500
3125
4·50000 in.

Ans. = 2 ac. 1 ro. 16 po. 3 yds. 7 ft. 4½ in.

7·243 days
24
972
486
5·832 hrs.
60
49·920 min.
60
55·200 sec.

Ans. 7d. 5 hrs. 49 min. 55⅕ sec.

1·43625 of £2. 10*s.*
50
71·81250*s.*
12
9·7500*d.*
4
3·00*q.*

Ans. = £3. 11*s.* 9¾*d.*

(8) 2 lbs. 7 oz. 15 dwts. = 635 dwts.

2·315
635
11575
6945
13890
1470·025

Ans. = $1470\frac{1}{4\cdot0}$ dwts.
= 6 lbs. 1 oz. $10\frac{1}{4\cdot0}$ dwts.

lea.
3·05
3
9·15 mi.
8
1·20 fur.
40
8·00 po.

Ans. = 9 mi. 1 fur. 8 po.

qrs.
11·732
28
5856
1464
20·496 lbs.
16
2976
496
7·936 oz.

Ans. = 2 cwt. 3 qrs. 20 lbs. $7\frac{11}{125}$ oz.

(9) ells
7·875
5
4·375 qrs.
4
1·500 nls.

Ans. = 7 ells 4 qrs. 1½ nls.

£1. 11*s*. 3*d*. = 375*d*.
1·605
375
8025
11235
4815
601·875 *d*.
4
3·500 *q*.

Ans. = £2. 10*s*. $1\frac{3}{4}$*d*. ½*q*.

sq. mi.
3·23571
640
942840
141426
150·85440 ac.
4
3·4176 ro.
40
16·7040 po.
30¼
21120
176
21·296 yds.
9
2·664 ft.
144
2656
2656
664
95·616 in.

Ans. = 3 sq. mi. 150 ac. 3 ro. 16 po. 21 yds. 2 ft. $95\frac{77}{125}$ in.

(10) 17 lbs. 2 oz. 2 scr. = 4946 scr.

scr.	
4946	
2·15	
24730	
4946	
9892	
10633·90 scr.	
20	
18·0 grs.	

6 hhds. 1 bar. = 10 bar.	
31·25	
10	
312·5 bar.	
36	
18·0 gal.	

Ans. = 208 hhds. 18 gal.

Ans. = 10633 scr. 18 grs.
= 36 lbs. 11 oz. 1 scr. 18 grs.

2. (1) $\dot{3}$ of £1 $= \frac{1}{3}$ of £1 $= \frac{20s.}{3} = 6s.\ 8d.$;

$\dot{6}$ of a guinea $= \left(\frac{6}{9} \text{ of } 21\right)s. = 14s.$;

$2\dot{6}$ of £1 $= \frac{26-2}{90}$ of £1 $= \frac{24}{90}$ of £1 $= \left(\frac{12}{45} \text{ of } 20\right)s.$

$= \frac{16}{3}s. = 5s.\ 4d.$

(2) $\cdot 135416\dot{6}$ of £1 $= \left(\frac{135416-13541}{900000} \text{ of } 20\right)s.$

$= \left(\frac{121875}{900000} \text{ of } 20\right)s. = \left(\frac{13}{96} \text{ of } 20\right)s.$

$= 2s.\ 8\frac{1}{2}d.$;

$3\cdot 40972\dot{2}$ of £1. 4s. $= \left(3\frac{40972-4097}{90000} \text{ of } 24\right)s.$

$= \left(3\frac{36875}{90000} \text{ of } 24\right)s. = \left(3\frac{59}{144} \text{ of } 24\right)s$

$= \frac{491}{6}s. = 81s.\ 10d. = £4.\ 1s.\ 10d.$;

$2\cdot 02\dot{7}$ of 4s. $7d. = (2\frac{27}{990} \text{ of } 55)d. = (2\frac{3}{110} \text{ of } 55)d.$

$= \frac{223}{2}d. = 111\frac{1}{2}d. = 9s.\ 3\frac{1}{2}d.$

(3) $\cdot 628\dot{8}$ of $7\frac{1}{2}$ guineas $= \left(\frac{628-62}{900} \text{ of } \frac{15}{2}\right)$ guineas

$= \left(\frac{283}{450} \text{ of } \frac{15}{2}\right)$ guineas $= \left(\frac{283}{60}\right)$ guineas

$= \left(\frac{283 \times 21}{60}\right) s. = £4.\ 19s.\ 0\frac{1}{2}d.\ \frac{1}{2}q.;$

$13 \cdot 27\dot{2}\dot{5}$ of 2 ac. 3 ro. $= \left(13\frac{275-2}{990} \text{ of } 2\frac{3}{4}\right)$ ac.

$= \left(13\frac{273}{990} \text{ of } \frac{11}{4}\right)$ ac. $= \left(13\frac{91}{330} \text{ of } \frac{11}{4}\right)$ ac.

$= \left(\frac{4381}{330} \times \frac{11}{4}\right)$ ac. $= \frac{4381}{120}$ ac.

$= 36$ ac. 2 ro. 1 po. 10 yds. 108 in.;

$1 \cdot 1\dot{4}\dot{5}$ of $\cdot 168\dot{3}$ lbs. $= \left(1\frac{145-1}{990} \text{ of } \frac{1683-168}{9000}\right)$ lbs.

$= \left(1\frac{144}{990} \text{ of } \frac{1515}{9000} \text{ of } 16\right)$ oz.

$= \left(1\frac{8}{55} \text{ of } \frac{101}{600} \text{ of } 16\right)$ oz.

$= \left(\frac{63}{55} \text{ of } \frac{101}{75} \text{ of } 2\right)$ oz.

$= \left(\frac{21 \times 101 \times 2}{55 \times 25}\right)$ oz. $= 3\frac{117}{1375}$ oz.

(4) $\cdot 72685\dot{1}$ of $27s. = \left(\frac{726851-726}{999000} \text{ of } 27\right)s.$

$= \left(\frac{726125}{999000} \text{ of } 27\right)s.$

$= \left(\frac{5809}{7992} \text{ of } 27\right)s. = \frac{5809}{296} s. = 19s.\ 7\frac{1}{2}d.;$

$\dot{3}40\dot{5}$ of 1 qr. 17 lbs. $= \left(\frac{3405-3}{9990} \text{ of } 45\right)$ lbs.

$= \frac{567}{37}$ lbs. $= 15$ lbs. $5\frac{7}{37}$ oz.;

$\cdot 06\dot{3}$ of 16 d. 12 hrs. $= \left(\frac{63-6}{900} \text{ of } 16\frac{1}{2}\right)$ d.

$= \left(\frac{57}{900} \text{ of } \frac{33}{2}\right)$ d. $= 1$ d. 1 h. 4 m. 48 sec.

3. $\cdot 725$ qr. $+ \cdot 275$ bus. $= (\cdot 725 \times 8 + \cdot 275)$ bus. $= 6 \cdot 075$ lbs.;

$\therefore$ value $= (80 \times 6 \cdot 075)d. = 486d. = £2.\ 0s.\ 6d.$

$1 \cdot 275$ yd. $+ 3 \cdot 75$ ft. $= (1 \cdot 275 \times 3 + 3 \cdot 75)$ ft. $= 7 \cdot 575$ ft.;

$\therefore$ value $= (40 \times 7 \cdot 575)d. = 303d. = £1.\ 5s.\ 3d.$

4. $\frac{3}{8}$ cwt. $= \cdot 375$ cwt., and $4 \cdot 16525$ tons $= 83 \cdot 30500$ cwt.;

$\therefore$ $4 \cdot 16525$ tons $- \frac{3}{8}$ cwt. $= (83 \cdot 305 - \cdot 375)$ cwt.

$= 82 \cdot 93$ cwt.

$= 4$ tons, 2 cwt. 3 qrs. 20 lbs. $2\frac{14}{25}$ oz.

$2 \cdot 0396$ of 1 mi. 530 yds. $- \cdot 867$ of $\frac{1}{2}$ mi.

$= (2 \cdot 0396$ of 2290 $- \cdot 867$ of 880) yds.

$= (4670 \cdot 684 - 762 \cdot 96)$ yds.

$= 3907 \cdot 724$ yds.

$= 3907$ yds. 2 ft. $2 \cdot 064$ in.

5. (1)

		crowns	guineas
	$2 \cdot 25$	$3 \cdot 1875$	$\cdot 375$
	$3 \cdot 5$	5	21
	1125	$15 \cdot 9375s.$	375
	675	12	750
	$7 \cdot 875s.$	$11 \cdot 2500d.$	$7 \cdot 875s.$
	12	4	12
	$10 \cdot 500d.$	$1 \cdot 0000q.$	$10 \cdot 500d.$
	4		4
	$2 \cdot 000q.$		$2 \cdot 000q.$

$\therefore$ value $= 7s.\ 10\frac{1}{2}d. + 15s.\ 11\frac{1}{4}d. - 7s.\ 10\frac{1}{2}d.$

$= £1.\ 3s.\ 9\frac{3}{4}d. - 7s.\ 10\frac{1}{2}d. = 15s.\ 11\frac{1}{4}d.$

4·275
20
85·500£
20
10·0*s.*

2·625
10·8
21000
2625
28·3500 guineas
21
35
70
7·35*s.*
12
4·20*d.*

5·375
·375
26875
37625
16125
2·015625£
20
·312500*s.*
12
3·7500*d.*

∴ value = £85. 10*s.* − £29. 15*s.* $4\frac{1}{6}d.$ + £2. 0*s.* $3\frac{3}{4}d.$
= £87. 10*s.* $3\frac{3}{4}d.$ − £29. 15*s.* $4\frac{1}{6}d.$
= £57. 14*s.* $11\frac{11}{12}d.$ = £57. 14*s.* $11\frac{1}{2}d.$ $\frac{1}{6}q.$

(3)

3·325
1·5
16625
3325
4·9875 tons
20
19·7500 cwt.
4
3·00 qrs.

$$4\,20\dot{6} \text{ of } 3 \text{ cwt. } 3 \text{ qrs.} = \left(4\frac{206-20}{900} \text{ of } 3\tfrac{3}{4}\right) \text{cwt.}$$
$$= \frac{631}{40} \text{ cwt.}$$
$$= 15 \text{ cwt. } 3\tfrac{1}{10} \text{ qr.}$$

$2{\cdot}25$ of $\cdot001$ of $100{\cdot}\dot{5}$ tons $= (2\frac{1}{4}$ of $\frac{1}{1000}$ of $100\frac{5}{9})$ tons

$= \frac{181}{40}$ cwt. $= 4$ cwt. $2\frac{1}{10}$ qrs.;

$\therefore$ value $= 4$ tons, 19 cwt. 3 qrs. $- 15$ cwt. $3\frac{1}{10}$ qrs.

$+ 4$ cwt. $2\frac{1}{10}$ qrs.

$= 5$ tons, 4 cwt. $1\frac{1}{10}$ qr. $- 15$ cwt. $3\frac{1}{10}$ qr.

$= 4$ tons, 8 cwt. 2 qrs.

Ex. XXVII. Page 77.

1. (1)

12 | 6·0	12 | 4·
2,0 | 2·50,0	2,0 | 5·3333...
·125	·2666...
12 | 3·	12 | 8·
2,0 | 7·25	2,0 | 16·666...
·3625	·8333...

(2)

4 | 1·	4 | 3·
12 | 10·25	12 | 9·75
2,0 | 3·854166...	2,0 | 4·8125
·19270833...	·240625
12 | 4·	4 | 2·
2,0 | ·3333...	12 | 0·5
·0166...	2,0 | 7·04166...
	·3520833...

(3)

4 | 3·	
12 | 6·75	$5s.\ 6d. = 66d.$; $13s.\ 4d. = 160d.$;
21 {3 | 6·5625	$\therefore\ 5s.\ 6d. = \frac{33}{80}$ of $13s.\ 4d.$
21 {7 | 2·1875	
·3125	80 {8 | 33·
	80 {10 | 4·125
	·4125

Again, 5*s.* 6*d.* $= \frac{11}{21}$ of 10*s.* 6*d.*

$$21 \begin{cases} 3 \\ 7 \end{cases} \Big| \begin{array}{l} 11\cdot \\ \hline 3\cdot666\ldots \end{array} \qquad \begin{array}{r|l} 12 & 6\cdot \\ 10 & \overline{5\cdot5} \end{array}$$

$$\cdot5238095\ldots \qquad \cdot55$$

(4) $6\frac{1}{2}d. = \frac{13}{60}$ of half-a-crown;

$$60 \begin{cases} 6 \\ 10 \end{cases} \Big| \begin{array}{l} 13 \\ \hline 2\cdot1666\ldots \end{array}$$

$$\cdot2166\ldots$$

$7\frac{1}{2}$ guineas $= £7.\ 17s.\ 6d.$

$$\begin{array}{r|l} 12 & 6\cdot \\ 2,0 & \overline{17\cdot5} \\ 1000 & \overline{7\cdot875} \end{array}$$

$$\cdot007875$$

$14s.\ 9\frac{3}{4}d. = 29$ sixpences $3\frac{3}{4}d.$

$$\begin{array}{r|l} 4 & 3\cdot \\ 6 & \overline{3\cdot75} \\ 21 \begin{cases} 3 \\ 7 \end{cases} & \overline{29\cdot625} \\ & \overline{9\cdot875} \end{array}$$

$$1\cdot4107142857\ldots$$

(5)
$$\begin{array}{r|l} 4 & 3\cdot \\ 12 & \overline{9\cdot75} \\ 2,0 & \overline{11\cdot8125} \end{array} \qquad \begin{array}{r|l} 4 & 3\cdot \\ 12 & \overline{9\cdot75} \\ 3,0 & \overline{51\cdot8125} \end{array}$$

$$\cdot590625 \qquad 1\cdot7270833\ldots$$

Ans. $= 2\cdot590625.$

$£2.\ 11s.\ 9\frac{3}{4}d. = 103$ sixpences $3\frac{3}{4}d.$

$$\begin{array}{r|l} 4 & 3\cdot \\ 6 & \overline{3\cdot75} \\ 21 \begin{cases} 3 \\ 7 \end{cases} & \overline{103\cdot625} \\ & \overline{34\cdot54166\ldots} \end{array}$$

$$4\cdot93452380952\ldots$$

$5\frac{3}{4}$ guineas = £5. 5s. + 15s. 9d. = £6. 0s. 9d.

12 | 9·
100 | 120·75
1·2075

(6)

4,0 | 26·
8 | 1·65
·20625

24 { 6 | 12·
4 | 2·
2,0 | 14·5
12 | ·725
·0604166...

12 | 7·5
3 | 2·625
4 | 6·875
1760 { 4 | 1·71875
11 | ·4296875
10 | ·0390625
·00390625

(7)

3 | 2·5
4·333
2
11 | 9·666
40 | 5·878787
·146969...

6,0 | 30·
6,0 | 15·5
24 { 3 | ·25833...
8 | ·0861111...
365 { 5 | ·010763888...
73 | ·002152777... (·00002949...
146
692
657
357
292
657
657

Ans. (1) ·25833...

Ans. (2) ·00002949...

(8)

63	8 | 1·	
	9 | 19·125	
	7 | 2·125	
	2 | ·30357...	
	·151785...	

9 | 7	
6 | 2·77777...	
·46296...	

(9)

	9 | 7·2	
	27·8	
	4	
121	11 | 111·2	
	11 | 10·1090909...	
	4,0 | ·9190082...	
	4 | ·02297520...	
	·005743...	

4 | 2·75	
8 | 5·6875	
5 | ·7109375	
·1421875	

(10) $\frac{2}{3}$ of a crown $= £\frac{2}{12} = £\frac{1}{6} = £\cdot166...$ of £1;

$\frac{5}{7}$ of half a crown $= £\frac{5}{7 \times 8} = £\frac{\cdot625}{7}$

$= \cdot0892857142...$ of £1;

$1\frac{17}{20}$ of 3*s.* 4*d.* $= £\frac{37 \times 40}{20 \times 240} = £\frac{37}{20 \times 6} = £\frac{1\cdot85}{6}$

$= \cdot30833...$ of £1.

(11) $3\cdot45$ of a guinea $= \frac{3\cdot45 \times 10\frac{1}{2}}{2\frac{1}{2}}$ of 2*s.* 6*d.*

$= (\cdot69 \times 21)$ of 2*s.* 6*d.* $= 14\cdot49$ of 2*s.* 6*d.*;

$\frac{7}{15}$ of 4 lbs. 15 dwts. $= \frac{\frac{7}{15} \times 975 \times 24}{5760}$ lb. Troy

$= \frac{91}{48}$ of a lb. Troy $= 1\cdot895833...$ of a lb. Troy;

$\frac{7}{15}$ of 4 lbs. 15 dwts. $= \frac{\frac{7}{15} \times 975 \times 24}{7000}$ lb. Avoird.

$= \frac{156}{100}$ lb. Avoird. $= 1\cdot56$ of a lb. Avoird.

(12) $\dot{0}\dot{5}$ of $\dot{0}\dot{6}$ of a mi. $= \frac{\frac{5}{99} \times \frac{6}{99}}{3}$ lea. $= \frac{5 \times 2}{99 \times 99}$ lea.

$= \cdot 001020304\ldots$ of a lea.;

$\frac{2}{5}$ of 2 cwt. 16 lbs. $= \frac{\frac{2}{5} \times 240}{\frac{7}{3} \times 20 \times 112}$ of $2\frac{1}{2}$ tons

$= \frac{9}{7 \times 10 \times 7}$ of $2\frac{1}{2}$ tons $= \cdot 018367\ldots$ of $2\frac{1}{2}$ tons.

2. £16·73125

20

14·62500*s.*

12

7·500*d.*

$\cdot\dot{3}$ of 7*s.* 6*d.* $= \frac{1}{3}$ of 7*s.* 6*d.* = 2*s.* 6*d.*

3·785

4

15·140*d.*

$\therefore$ £16·73125 + $\frac{1}{3}$ of 7*s.* 6*d.* + 3·785 of 4*d.*

= £16. 14*s.* 7·5*d.* + 2*s.* 6*d.* + 1*s.* 3·14*d.* = £16. 18*s.* 4·64*d.*

12	4·64
2,0	18·38666...
2,0	16·919333...
	·8459666...

12	4·64
21 {3	338·386666...
21 {7	112·795555...
2,0	16·113650...
	·805682...

$\therefore$ Answers are ·8459666... and ·805682...

3. $\frac{6}{7}$ of £1 + $\frac{3}{8}$ of a guinea + $\frac{3}{560}$ of 6*s.* 8*d.* + $\frac{1}{14}$ of 2*s.* 6*d.*

= 17*s.* $1\frac{5}{7}$*d.* + 7*s.* $10\frac{1}{2}$*d.* + $\frac{3}{7}$*d.* + $2\frac{1}{7}$*d.*

= £1. 5*s.* $2\frac{11}{14}$*d.*

14 {2	11·
14 {7	5·5
12	2·7857142...
2,0	25·2321428...
100	1·26160714...
	·01261607...

14 {2	11·
14 {7	5·5
6	2·7857142...
21 {3	50·464285...
21 {7	16·821428...
	2·40306...

4. 1 sheet $= \frac{\frac{1}{8}}{24}$ of an in. $= \frac{\cdot125}{24}$ of an in.

$= \frac{\cdot015625}{3}$ of an in. $= \cdot00520833\ldots$ of an in.

MISCELLANEOUS EXAMPLES IN DECIMALS.

Ex. XXVIII. Page 82.

1. No. of men $= \cdot3 \times 2000 = 600$,

..... women $= \cdot175 \times 2000 = 350$;

$\therefore$ No. of children $= 2000 - (600 + 350) = 1050$.

2. Denoting estate by unity, or 1,

residue of estate $= 1 - (\cdot45 + \cdot25) = \cdot3$.

Now $\frac{3}{10} = £100$;

$\therefore \frac{1}{10} = \frac{1}{3}$ of $£100 = £33.\ 6s.\ 8d.$;

$\therefore$ 1, or unity, or estate $= £33.\ 6s.\ 8d. \times 10$

$= £333.\ 6s.\ 8d.$

3.
$$\begin{array}{r|l} 12 & 6\cdot \\ 2,0 & \overline{10\cdot5} \\ & \overline{\cdot525} \end{array}$$

$\therefore$ £1. 10*s.* 6*d.* $= £1\cdot525$

$= 15\mathit{fl}.\ 2c.\ 5m.$

$$\begin{array}{r|l} 4 & 2\cdot \\ 12 & \overline{9\cdot5} \\ 2,0 & \overline{16\cdot79166} \\ & \overline{\cdot8395833} \end{array}$$

$\therefore$ 16*s.* $9\frac{1}{2}d. = 8\mathit{fl}.\ 3c.\ 9\cdot583\frac{3}{4}m.$

$$\begin{array}{r|l} 4 & 3\cdot \\ 12 & \overline{0\cdot75} \\ 2,0 & \overline{\cdot0625} \\ & \overline{\cdot003125} \end{array}$$

$\therefore$ £2. 0*s.* $0\frac{3}{4}d. = £2\cdot003125$

$= 20\mathit{fl}.\ 0c.\ 3\frac{1}{4}m.$

$$\begin{array}{r|l} 19 & 11\cdot15 \\ 2,0 & \overline{19\cdot929166\ldots} \\ & \overline{\cdot9964583\ldots} \end{array}$$

$\therefore$ 19*s.* 11·15*d.* $= 9\mathit{fl}.\ 9c.\ 6\cdot458\frac{3}{4}m.$

4. $\cdot025 \times \cdot07 = \frac{25}{1000} \times \frac{7}{100} = \frac{175}{100000}$;

$11\cdot035 \times \cdot0008 = \frac{11035}{1000} \times \frac{8}{10000} = \frac{88280}{10000000} = \frac{8828}{1000000}$;

$\cdot1\dot{9} \times \cdot00\dot{3} = \frac{18}{90} \times \frac{3}{900} = \frac{54}{81000} = \frac{2}{3000} = \frac{2000}{3000000}$;

therefore the equivalent fractions are

$$\frac{175}{100000}, \quad \frac{8828}{1000000}, \quad \frac{2000}{3000000}$$

$$= \frac{5250}{3000000}, \quad \frac{26484}{3000000}, \quad \frac{2000}{3000000};$$

$\therefore$ $11\cdot035 \times \cdot0008$ is the greatest, and $\cdot1\dot{9} \times \cdot00\dot{3}$ is the least.

5. $\cdot7$ of 630 people $= 441\cdot0$, or 441 people,

$\cdot\dot{7}$ of 630 ..... $= \frac{7}{9}$ of 630, or 490 .....

$\cdot3\dot{6}$ of 630 ..... $= \frac{11}{30}$ of 630, or 231 .....

6. 1145 ac. 1 ro. = 5543010 sq. yds.;

$\therefore$ No. of ares $= \frac{5543010}{119\cdot6033} = 46344\cdot9\ldots$

$= 463$ hectar. 45 ares, nearly.

7. 1 lb. Avoird. = 7000 grs.
1 gram. = 15·432 grs.;

$\therefore$ Ans. $= \frac{7000}{15\cdot432}$ grammes $= 453\cdot602\ldots$ grammes

$= 4$ hectog. 5 décag. 3 gr. $6\cdot02\ldots$ décig.

1 lb. Troy = 5760 grs.;

$\therefore$ Ans. $= \frac{5760}{15\cdot432}$ grammes $= 373\cdot25\ldots$ grammes

$= 3$ hectog. 7 décag. 3 gr. $2\cdot5\ldots$ déeig.

167 stères 4 décist. $= 167\cdot4$ stères;

$\therefore$ No. of cub. ft. $= (35\cdot317 \times 167\cdot4) = 5912\cdot0658$
$= 5912$ cub. ft. $113\cdot7024$ cub. in.

8. $\text{No.} = \frac{851 \times \cdot00016}{\cdot032} = \frac{851}{2 \times 100} = \frac{425 \cdot 5}{100} = 4 \cdot 255.$

9. $\text{A Nap.} = \frac{20}{25 \cdot 15}$ of £1 $= \frac{4}{5 \cdot 03}$ of £1

$= \frac{16}{5 \cdot 03}$ of 5*s.* $= 3 \cdot 1809\ldots$ of 5*s.*

$= \frac{32}{5 \cdot 03}$ of 2*s.* 6*d.* $= 6 \cdot 3618\ldots$ of 2*s.* 6*d.*

$= \frac{40}{5 \cdot 03}$ of 2*s.* $= 7 \cdot 9522\ldots$ of 2*s.*

$= \frac{80}{5 \cdot 03}$ of 1*s.* $= 15 \cdot 9045\ldots$ of 1*s.*

$= \frac{160}{5 \cdot 03}$ of 6*d.* $= 31 \cdot 809\ldots$ of 6*d.*

$= \frac{240}{5 \cdot 03}$ of 4*d.* $= 47 \cdot 713\ldots$ of 4*d.*

$= \frac{320}{5 \cdot 03}$ of 3*d.* $= 63 \cdot 618\ldots$ of 3*d.*

10 francs $= \frac{10}{25 \cdot 15}$ of £1 $= \frac{8}{5 \cdot 03}$ of 5*s.* $= 1 \cdot 59045\ldots$ of 5*s.*

$= \frac{16}{5 \cdot 03}$ of 2*s.* 6*d.* $= 3 \cdot 1809\ldots$ of 2*s.* 6*d.*

$= \frac{20}{5 \cdot 03}$ of 2*s.* $= 3 \cdot 9761\ldots$ of 2*s.*

$= \frac{40}{5 \cdot 03}$ of 1*s.* $= 7 \cdot 9522\ldots$ of 1*s.*

$= \frac{80}{5 \cdot 03}$ of 6*d.* $= 15 \cdot 9045\ldots$ of 6*d.*

$= \frac{120}{5 \cdot 03}$ of 4*d.* $= 23 \cdot 8567\ldots$ of 4*d.*

$= \frac{160}{5 \cdot 03}$ of 3*d.* $= 31 \cdot 8091\ldots$ of 3*d.*

10. (1) Bin holds $3\frac{1}{2}$ qrs. $(3\frac{1}{2} \times 8 \times 8)$ gals. $= 224$ gals.;

$\therefore$ bin contains $(224 \times 277{\cdot}274)$ cub. in.

$$= \frac{224 \times 277{\cdot}274}{61{\cdot}028} \text{ litres}$$

$$= 1017{\cdot}719\ldots \text{litres.}$$

(2) Barrel contains $\dfrac{36 \times 277{\cdot}274}{61{\cdot}028}$ litres

$$= 163{\cdot}562\ldots \text{litres.}$$

11.

12	8·
3	1·6666
2	74·5555
11	37·27777
	3·388888

Ans. $= 3{\cdot}3\dot{8}$ chains

$= 3$ chains, 3 chainlets, 8 links, $8{\cdot}\dot{8}$ linklets.

12. Minute-hand travels per week

$$= 7 \times 3{\cdot}14159 \times 24 \times 7 \times 12 \text{ in.}$$

Hour-hand travels per week $= (64 \times 3{\cdot}14159 \times 2 \times 7)$ in.;

$\therefore$ No. of in. minute-hand travels more in a week than hour-hand

$$= 7 \times 3{\cdot}14159 \times 24 \times 7 \times 12 - 64 \times 3{\cdot}14159 \times 2 \times 7$$

$$= 7 \times 16 \times 3{\cdot}14159 \times \{126 - 8\}$$

$$= 7 \times 16 \times 3{\cdot}14159 \times 118;$$

$\therefore$ No. of metres minute-hand travels more in a week than hour-hand

$$= \frac{7 \times 16 \times 3{\cdot}14159 \times 118}{39{\cdot}3708}$$

$$= 1054{\cdot}56\ldots\ldots$$

$$= 1054\tfrac{1}{2} \text{ nearly.}$$

SQUARE ROOT.—Ex. XXIX. Page 89.

1. (1) $\dot{1}6\dot{9}$ (13 — 1; 23 | 69, 69

$\dot{8}2\dot{4}$ (18 — 1; 28 | 224, 224

$72\dot{9}$ (27 — 4; 47 | 329, 329

$12\dot{2}5$ (35 — 9; 65 | 325, 325

$16\dot{8}1$ (41 — 16; 81 | 81, 81

$5\dot{7}7\dot{6}$ (76 — 49; 146 | 876, 876

$8\dot{1}0\dot{0}$ (90

(2) $\dot{1}0000$ (100

$\dot{1}2\dot{7}6\dot{9}$ (113 — 1; 21 | 27, 21; 223 | 669, 669

$\dot{4}1\dot{2}0\dot{9}$ (203 — 4; 403 | 1209, 1209

$7\dot{1}7\dot{4}0\dot{9}$ (847 — 64; 164 | 774, 656; 1687 | 11809, 11809

$9\dot{4}8\dot{6}7\dot{6}$ (974 — 81; 187 | 1386, 1309; 1944 | 7776, 7776

(3) $\dot{7}3\dot{0}0\dot{8}0\dot{4}$ (2702 — 4; 47 | 330, 329; 5402 | 10804, 10804

$16\dot{7}52\dot{6}4\dot{9}$ (4093 — 16; 809 | 7526, 7281; 8183 | 24549, 24549

$$
\begin{array}{r|l}
 & 9\dot{7}5\dot{3}5\dot{3}7\dot{6} \;(9876 \\
 & 81 \\
\hline
188 & 1653 \\
 & 1504 \\
\hline
1967 & 14953 \\
 & 13769 \\
\hline
19746 & 118476 \\
 & 118476 \\
\hline
\end{array}
$$

$$
\begin{array}{r|l}
 & 2\dot{8}9\dot{1}7\dot{0}0\dot{2}5 \;(17005 \\
 & 1 \\
\hline
27 & 189 \\
 & 189 \\
\hline
34005 & 170025 \\
 & 170025 \\
\hline
\end{array}
$$

$$
\begin{array}{r|l}
(4) & 5\dot{0}\cdot2\dot{6}8\dot{1} \;(7\cdot09 \\
 & 49 \\
\hline
1409 & 12681 \\
 & 12681 \\
\hline
\end{array}
$$

$$
\begin{array}{r|l}
 & 5\dot{1}8\dot{6}\cdot1\dot{6}0\dot{2}2\dot{5} \;(72\cdot015 \\
 & 49 \\
\hline
142 & 286 \\
 & 284 \\
\hline
14401 & 21602 \\
 & 14401 \\
\hline
144025 & 720125 \\
 & 720125 \\
\hline
\end{array}
$$

$$
\begin{array}{r|l}
 & \cdot0\dot{0}0\dot{1}6\dot{9}\dot{5}2\dot{0}4 \;(\cdot01302 \\
 & 1 \\
\hline
23 & 69 \\
 & 69 \\
\hline
2602 & 5204 \\
 & 5204 \\
\hline
\end{array}
$$

$$
\begin{array}{r|l}
 & 1\cdot5\dot{2}4\dot{1}5\dot{7}8\dot{7}5\dot{0}1\dot{9}0\dot{5}2\dot{1} \;(1\cdot23456789 \\
 & 1 \\
\hline
22 & 52 \\
 & 44 \\
\hline
243 & 841 \\
 & 729 \\
\hline
2464 & 11257 \\
 & 9856 \\
\hline
24685 & 140187 \\
 & 123425 \\
\hline
246906 & 1676250 \\
 & 1481436 \\
\hline
2469127 & 19481419 \\
 & 17283889 \\
\hline
24691348 & 219753005 \\
 & 197530784 \\
\hline
246913569 & 2222222121 \\
 & 2222222121 \\
\hline
\end{array}
$$

2. (1)

$$\begin{array}{r|l} & 19\cdot0\dot{0}\dot{0}\dot{0}\dot{0}\dot{0}\dot{0} \;(\; 4\cdot3588\ldots \\ & 16 \\ \hline 83 & 300 \\ & 249 \\ \hline 865 & 5100 \\ & 4325 \\ \hline 8708 & 77500 \\ & 69664 \\ \hline 87168 & 783600 \\ & 697344 \\ \hline & 86256 \end{array}$$

$$\begin{array}{r|l} & 72\cdot0\dot{0}\dot{0}\dot{0}\dot{0}\dot{0}\dot{0} \;(\; 8\cdot4852\ldots \\ & 64 \\ \hline 164 & 800 \\ & 656 \\ \hline 1688 & 14400 \\ & 13504 \\ \hline 16965 & 89600 \\ & 84825 \\ \hline 169702 & 477500 \\ & 339404 \\ \hline & 138096 \end{array}$$

(2)

$$\begin{array}{r|l} & \dot{7}\cdot0\dot{0}\dot{0}\dot{0}\dot{0}\dot{0}\dot{0} \;(\; 2\cdot6457 \\ & 4 \\ \hline 46 & 300 \\ & 276 \\ \hline 524 & 2400 \\ & 2096 \\ \hline 5285 & 30400 \\ & 26425 \\ \hline 52907 & 397500 \\ & 370349 \\ \hline & 27151 \end{array}$$

$$\begin{array}{r|l} & \dot{1}2\dot{1}00\dot{0}\dot{0} \,(\cdot 3478 \\ & 9 \\ \hline 64 & 310 \\ & 256 \\ \hline 687 & 5400 \\ & 4809 \\ \hline 6948 & 59100 \\ & 55584 \\ \hline & 3516 \end{array}$$

(3)

$$\begin{array}{r|l} & \dot{7}6\dot{1}\cdot 9\dot{0}\dot{0}\dot{0}\dot{0}\dot{0}\dot{0} \,(27\cdot 6025 \\ & 4 \\ \hline 47 & 361 \\ & 329 \\ \hline 546 & 3290 \\ & 3276 \\ \hline 55202 & 140000 \\ & 110404 \\ \hline 552045 & 2959600 \\ & 2760225 \\ \hline & 199375 \end{array}$$

$$\begin{array}{r|l} & \cdot 0\dot{0}0\dot{3}8\dot{4}1\dot{0} \,(\cdot 0195 \\ & 1 \\ \hline 29 & 284 \\ & 261 \\ \hline 385 & 2310 \\ & 1925 \\ \hline & 385 \end{array}$$

3. (1)

$$\begin{array}{r|l} & 1\dot{2}2\dot{5} \,(35 \\ & 9 \\ \hline 65 & 325 \\ & 325 \end{array} \qquad \begin{array}{r|l} & 9\dot{2}1\dot{6} \,(96 \\ & 81 \\ \hline 186 & 1116 \\ & 1116 \end{array}$$

$$\therefore \sqrt{\frac{1225}{9216}} = \frac{35}{96}.$$

$$\begin{array}{r|l} 1521 & (39 \\ 9 & \\ \hline 69 \mid 621 & \\ \quad 621 & \\ \hline \end{array} \qquad \begin{array}{r|l} 632025 & (795 \\ 49 & \\ \hline 149 \mid 1420 & \\ \quad 1341 & \\ \hline 1585 \mid 7925 & \\ \quad 7925 & \\ \hline \end{array}$$

$$\therefore \sqrt{\frac{1521}{632025}} = \frac{39}{795}.$$

(2) $3\frac{1}{3} = 3{\cdot}666666\ldots$

$$\begin{array}{r|l} 3{\cdot}666666\ldots & (1{\cdot}9148\ldots \\ 1 & \\ \hline 29 \mid 266 & \\ \quad 261 & \\ \hline 381 \mid 566 & \\ \quad 381 & \\ \hline 3824 \mid 18566 & \\ \quad 15296 & \\ \hline 38288 \mid 327000 & \\ \quad 306304 & \\ \hline 20696 & \end{array}$$

$$33\tfrac{144}{225} = \frac{7569}{225};$$

$$\begin{array}{r|l} 7569 & (87 \\ 64 & \\ \hline 167 \mid 1169 & \\ \quad 1169 & \\ \hline \end{array} \qquad \begin{array}{r|l} 225 & (15 \\ 1 & \\ \hline 25 \mid 125 & \\ \quad 125 & \\ \hline \end{array}$$

$$\therefore \sqrt{33\tfrac{144}{225}} = \frac{87}{15} = 5\tfrac{4}{5}.$$

(3) $12{\cdot}314141\ldots \quad (3{\cdot}509\ldots$

$$\begin{array}{r|l} & \\ 9 & \\ \hline 65 \mid 331 & \\ \quad 325 & \\ \hline 7009 \mid 64141 & \\ \quad 63081 & \\ \hline 1060 & \end{array}$$

$$\cdot 079555555 \quad (\cdot 28205\ldots$$

$$\begin{array}{r|l} & \\ 4 & \\ \hline 48 \mid 395 & \\ \quad 384 & \\ \hline 562 \mid 1155 & \\ \quad 1124 & \\ \hline 56405 \mid 315555 & \\ \quad 282025 & \\ \hline 33530 & \end{array}$$

(4) $\sqrt{\frac{3\frac{1}{4}}{4\frac{1}{2}}} = \sqrt{\frac{7}{9}} = \frac{\sqrt{7}}{3} = \frac{2{\cdot}6457\ldots}{3} = {\cdot}8819\ldots$

$$
\begin{array}{r|l}
 & \dot{1}\dot{2}0\dot{8}\dot{8}\dot{8}{\cdot}6\dot{8}\dot{3}7\dot{9}0\dot{2}\dot{5}\ (347{\cdot}6905 \\
 & 9 \\
\hline
64 & 808 \\
 & 256 \\
\hline
687 & 5288 \\
 & 4809 \\
\hline
6946 & 47968 \\
 & 41676 \\
\hline
69529 & 629287 \\
 & 625761 \\
\hline
6953805 & 34769025 \\
 & 34769025 \\
\hline
\end{array}
$$

4. 18 ac. 36 po. $= 2916$ po. $= (2916 \times 30\frac{1}{4})$ sq. yds.
$= (729 \times 121)$ sq. yds.

Now $\sqrt{(729 \times 121)} = (27 \times 11) = 297$.

$\therefore$ Ans. $= 297$ yds.

5. No. of sq. yds. $= \frac{9245}{45} = \frac{1849}{9}$;

$$
\begin{array}{r|l}
 & \dot{1}\dot{8}\dot{4}\dot{9}\ (43 \\
 & 16 \\
\hline
83 & 249 \\
 & 249 \\
\hline
\end{array}
$$

$\therefore$ side of court-yard $= \frac{43}{3}$ yds. $= 14$ yds. 1 ft.

6. 2 hectar. 56·333 ares $= 256{\cdot}333$ ares $= 25633{\cdot}3$ sq. m.

$$
\begin{array}{r|l}
 & \dot{2}\dot{5}6\dot{3}\dot{3}{\cdot}\dot{3}0\ldots\ (160{\cdot}104\ldots \text{ m.} \\
 & 1 \\
\hline
26 & 156 \\
 & 156 \\
\hline
3201 & 3330 \\
 & 3201 \\
\hline
320204 & 1290000 \\
 & 1280816 \\
\hline
 & 9184
\end{array}
$$

7. Area of circle $= \{3{\cdot}1416 \times (15)^2\}$ sq. yds.
$= (3{\cdot}1416 \times 225)$ sq. yds. $= 706{\cdot}8600$ sq. yds.

	$\dot{7}0\dot{6}\cdot\dot{8}6\dot{0}0\ldots$	(26·586
	4	
46	306	
	276	
525	3086	
	2625	
5308	46100	
	42464	
53166	363600	
	318996	
	44604	

$\therefore$ side of square $= 26{\cdot}586\ldots$ yds.

8. In 6 hours one travels 72 miles,
..... the other .... 54 .....

and since they go in directions at right angles to each other,

distance in miles $= \sqrt{(72)^2 + (54)^2} = \sqrt{(5184 + 2916)}$
$= \sqrt{8100} = 90.$

CUBE ROOT.—Ex. XXX. Page 96.

1. (1)

	$\dot{1}\dot{7}\dot{4}\dot{4}$	(14
	1	
$3 \times 1^2 = 3$	1744	
$3 \times 10^2 = 300$		
$3 \times 10 \times 4 = 120$		
$4^2 = 16$		
436		
4		
1744	1744	

$$
\begin{array}{rl|l}
 & & 17\dot{5}76\dot{} \ (26 \\
 & & 8 \\
\hline
3\times 2^2 = 12 & & 9576 \\
3\times(20)^2 = 1200 & & \\
3\times 20\times 6 = \ 360 & & \\
6^2 = \ \ 36 & & \\
\hline
1596 & & \\
\ \ 6 & & \\
\hline
9576 & & 9576 \\
\end{array}
$$

$$
\begin{array}{rl|l}
 & & 54\dot{8}72\dot{} \ (38 \\
 & & 27 \\
\hline
3\times 3^2 = 27 & & 27872 \\
3\times(30)^2 = 2700 & & \\
3\times 30\times 8 = \ 720 & & \\
8^2 = \ \ 64 & & \\
\hline
3484 & & \\
\ \ 8 & & \\
\hline
27872 & & 27872 \\
\end{array}
$$

(2) $125\dot{0}0\dot{0}0\dot{} \ (50$

$$
\begin{array}{rl|l}
 & & 287\dot{4}96\dot{} \ (66 \\
 & & 216 \\
\hline
3\times(6)^2 = 108 & & 71496 \\
3\times(60)^2 = 10800 & & \\
3\times(60)\times 6 = \ 1080 & & \\
6^2 = \ \ \ 36 & & \\
\hline
11916 & & \\
\ \ \ 6 & & \\
\hline
71496 & & 71496 \\
\end{array}
$$

(3)

$$
\begin{array}{rl|l}
 & & 357\dot{9}11\dot{} \ (71 \\
 & & 343 \\
\hline
3\times 7^2 = 147 & & 14911 \\
3\times(70)^2 = 14700 & & \\
3\times 70\times 1 = \ \ 210 & & \\
1^2 = \ \ \ \ 1 & & \\
\hline
14911 & & 14911 \\
\end{array}
$$

$70\dot{4}96\dot{9}$ (89
512

$3 \times 8^2 = 192$	192969
$3 \times (80)^2 = 19200$	
$3 \times 80 \times 9 = 2160$	
$9^2 = 81$	
21441	
9	
192969	192969

$94\dot{1}19\dot{2}$ (98
729

$3 \times 9^2 = 243$	212192
$3 \times (90)^2 = 24300$	
$3 \times 90 \times 8 = 2160$	
$8^2 = 64$	
26524	
8	
212192	212192

$68\dot{1}47\dot{2}$ (88
512

$3 \times 8^2 = 192$	169472
$3 \times (80)^2 = 19200$	
$3 \times 80 \times 8 = 1920$	
$8^2 = 64$	
21184	
8	
169472	169472

$75\dot{3}57\dot{1}$ (91
729

$3 \times 9^2 = 243$	24571
$3 \times (90)^2 = 24300$	
$3 \times 90 \times 1 = 270$	
$1^2 = 1$	
24571	
1	
24571	24571

$\dot{1}3\dot{4}2\dot{1}7\dot{7}2\dot{8}$ (512
125

$3 \times 5^2 = 75$	9217
$3 \times (50)^2 = 7500$	
$3 \times 50 \times 1 = 150$	
$1^3 = 1$	
7651	
1	
7651	7651
$3 \times (51)^2 = 7803$	1566728
$3 \times (510)^2 = 780300$	
$3 \times 510 \times 2 = 3060$	
$2^3 = 4$	
783364	
2	
1566728	1566728

$\dot{1}\dot{1}9\dot{4}3\dot{8}9\dot{9}8\dot{1}$ (1061
1

$3 \times (10)^2 = 300$	194389
$3 \times (100)^2 = 30000$	
$3 \times 100 \times 6 = 1800$	
$6^3 = 36$	
31836	
6	
191016	191016
$3 \times (106)^2 = 33708$	3373981
$3 \times (1060)^2 = 3370800$	
$3 \times 1060 \times 1 = 3180$	
$1^3 = 1$	
3373981	
1	
3373981	3373981

(6)

$\dot{5}\dot{8}6376\dot{2}5\dot{3}$ (837
512

$3 \times 8^2 = 192$	74376
$3 \times (80)^2 = 19200$	
$3 \times 80 \times 3 = 720$	
$3^2 = 9$	
19929	
3	
59787	59787
$3 \times (83)^2 = 20667$	14589253
$3 \times (830)^2 = 2066700$	
$3 \times 830 \times 7 = 17430$	
$7^2 = 49$	
2084179	
7	
14589253	14589253

$2\dot{8}9\dot{3}4\dot{4}4\dot{3}$ (307
27

$3 \times (30)^2 = 2700$	1934443
$3 \times (300)^2 = 270000$	
$3 \times 300 \times 7 = 6300$	
$7^2 = 49$	
276349	
7	
1934443	1934443

$1\dot{2}2\dot{3}0\dot{5}9\dot{0}4\dot{6}4$ (2304
8

$3 \times 2^2 = 12$	4230
$3 \times (20)^2 = 1200$	
$3 \times 20 \times 3 = 180$	
$3^2 = 9$	
1389	
3	
4167	4167
$3 \times (230)^2 = 158700$	63590464
$3 \times (2300)^2 = 15870000$	
$3 \times 2300 \times 4 = 27600$	
$4^2 = 16$	
15897616	
4	
63590464	63590464

(7)

$\dot{2}\cdot 62\dot{8}07\dot{2}$ (1·38

1

$3\times 1^2=3$	1628
$3\times(10)^2=300$	
$3\times 10\times 3=\ 90$	
$3^2=\ 9$	
399	
3	
1197	1197
$3\times(13)^2=507$	431072
$3\times(130)^2=50700$	
$3\times 130\times 8=\ 3120$	
$8^2=\ 64$	
53884	
8	
431072	431072

$\cdot 000\dot{9}1\dot{2}67\dot{3}$ (·027

729

$3\times 9^2=243$	183673
$3\times(90)^2=24300$	
$3\times 90\times 7=\ 1890$	
$7^2=\ 49$	
26239	
7	
183673	183673

$\dot{2}\dot{7}0\dot{5}\dot{4}0\dot{3}\dot{6}\cdot 00\dot{8}$ (300·2

27

$3\times(300)^2=270000$	54036008
$3\times(3000)^2=27000000$	
$3\times 3000\times 2=\ 18000$	
$2^2=\ 4$	
27018004	
2	
54036008	54036008

(8) $\sqrt[3]{\frac{8}{27}} = \frac{2}{3}$.

·000100000 (·046...

64

$3 \times 4^2 = 48$	36000
$3 \times (40)^2 = 4800$	
$3 \times 40 \times 6 = 720$	
$6^2 = 36$	
5556	
6	
33336	33336
	2664

3·000000000 (1·442...

1

$3 \times 1^2 = 3$	2000
$3 \times (10)^2 = 300$	
$3 \times 10 \times 4 = 120$	
$4^2 = 16$	
436	
4	
1744	1744
$3 \times (14)^2 = 588$	256000
$3 \times (140)^2 = 58800$	
$3 \times 140 \times 4 = 1680$	
$4^2 = 16$	
60496	
4	
241984	241984
$3 \times (144)^2 = 62208$	14016000
$3 \times (1440)^2 = 6220800$	
$3 \times 1440 \times 2 = 8640$	
$2^2 = 4$	
6229444	
2	
12458888	12458888
	1557112

·300000000 (·669...
216

$3 \times 6^2 = 108$	84000
$3 \times (60)^2 = 10800$	
$3 \times 60 \times 6 = 1080$	
$6^2 = 36$	
11916	
6	
71496	71496
$3 \times (66)^2 = 13068$	12504000
$3 \times (660)^2 = 1306800$	
$3 \times 660 \times 9 = 17820$	
$9^2 = 81$	
1324701	
9	
11922309	11922309
	581691

517·000000000 (8·025...
512

$3 \times (80)^2 = 19200$	5000000
$3 \times (800)^2 = 1920000$	
$3 \times 800 \times 2 = 4800$	
$2^2 = 4$	
1924804	
2	
3849608	3849608
$3 \times (805)^2 = 1944075$	1150392000
$3 \times (8050)^2 = 194407500$	
$3 \times 8050 \times 5 = 120750$	
$5^2 = 25$	
194528275	
5	
972641375	972641375
	177750625

$44\dot{4}\cdot60\dot{0}0\dot{0}0\dot{0}0\dot{0}$ (3·546...

27

$3\times3^2=27$	17600
$3\times(30)^2=2700$	
$3\times30\times5=450$	
$5^2=25$	
3175	
5	
15875	15875
$3\times(35)^2=3675$	1725000
$3\times(350)^2=367500$	
$3\times350\times4=4200$	
$4^2=16$	
371716	
4	
1486864	1486864
$3\times(354)^2=375948$	238136000
$3\times(3540)^2=37594800$	
$3\times3540\times6=63720$	
$5^2=36$	
37658556	
6	
225951336	225951336
	12184664

$5\dot{0}6\dot{5}\dot{3}$ (37

27

$3\times3^2=27$	23653
$3\times(30)^2=2700$	
$3\times30\times7=630$	
$7^2=49$	
3379	
7	
23653	23653

$$
\begin{array}{rl|l}
 & \dot{1}36\dot{7}63\dot{1}\ (111 & \\
 & 1 & \\
\hline
3\times1^2=3 & 367 & \\
3\times(10)^2=300 & & \\
3\times10\times1=\ 30 & & \\
1^3=\ \ 1 & & \\
\hline
331 & & \\
\ \ 1 & & \\
\hline
331 & 331 & \\
\hline
3\times(11)^2=363 & 36631 & \\
3\times(110)^2=36300 & & \\
3\times110\times1=\ 330 & & \\
1^3=\ \ 1 & & \\
\hline
36631 & & \\
\ \ 1 & & \\
\hline
36631 & 36631 & \\
\hline
\end{array}
$$

$$\therefore \sqrt[3]{\frac{50653}{1367631}} = \frac{37}{111} = \frac{1}{3}.$$

2.

$$
\begin{array}{rl|l}
 & \cdot0\dot{0}0\dot{0}0\dot{0}4\dot{5}6\dot{9}7\dot{6}\ (\cdot000676 & \\
 & 36 & \\
\hline
127 & 969 & \\
 & 889 & \\
\hline
1346 & 8076 & \\
 & 8076 & \\
\hline
\end{array}
$$

$$
\begin{array}{rl|l}
 & \cdot0\dot{0}0\dot{6}7\dot{6}\ (\cdot026 & \\
 & 4 & \\
\hline
46 & 276 & \\
 & 276 & \\
\hline
\end{array}
$$

Ans. = ·026.

$$\begin{array}{rl|l}
 & \dot{0}0\dot{0}5\dot{9}4\dot{8}2\dot{3}3\dot{2}\dot{1} & (\cdot 0841 \\
 & 512 & \\
\hline
3\times 8^2=192 & 82823 & \\
3\times(80)^2=19200 & & \\
3\times 80\times 4= \quad 960 & & \\
4^2= \quad 16 & & \\
\hline
20176 & & \\
4 & & \\
\hline
80704 & 80704 & \\
\hline
3\times(84)^2=21168 & 2119321 & \\
3\times(840)^2=2116800 & & \\
3\times 840\times 1= \quad 2520 & & \\
1^2= \quad 1 & & \\
\hline
2119321 & & \\
1 & & \\
\hline
2119321 & 2119321 & \\
\hline
\end{array}$$

$$\begin{array}{rl|l}
 & \cdot 0\dot{8}4\dot{1} & (\cdot 29 \\
 & 4 & \\
\hline
49 & 441 & \\
 & 441 & \\
\hline
\end{array}$$

Ans. $=\cdot 29$.

3. Length of edge $=\sqrt[3]{(233744896\times\cdot 008)}$ in.;

$$\begin{array}{rl|l}
 & 2\dot{3}3\dot{7}4\dot{4}8\dot{9}6 & (616 \\
 & 216 & \\
\hline
3\times 6^2=108 & 17744 & \\
3\times(60)^2=10800 & & \\
3\times 60\times 1= \quad 180 & & \\
1^2= \quad 1 & & \\
\hline
10981 & 10981 & \\
\hline
3\times(61)^2=11163 & 6763896 & \\
3\times(610)^2=1116300 & & \\
3\times 610\times 6= \quad 10980 & & \\
6^2= \quad 36 & & \\
\hline
1127316 & & \\
6 & & \\
\hline
6763896 & 6763896 & \\
\hline
\end{array}$$

$\therefore$ length of edge $=(616\times\cdot 2)$ in. $=123\cdot 2$ in. $=3$ yds. 1 ft. $3\frac{1}{5}$ in.

4. Since £15946. 17*s.* 6*d.* = 637875 sixpences,

no. of cubic ft. in mass = 637875 ÷ 7 = 91125;

$$\begin{array}{rl|l} & & 91125 \\ & & 64 \\ \hline 3 \times 4^2 = & 48 & 27125 \\ 3 \times (40)^2 = & 4800 & \\ 3 \times 40 \times 5 = & 600 & \\ 5^2 = & 25 & \\ \hline & 5425 & \\ & 5 & \\ \hline & 27125 & 27125 \end{array}$$

$\therefore$ length of edge = 45 ft. = **15** yds.

MISCELLANEOUS QUESTIONS AND EXAMPLES.

I. Page 97.

1. (1) Time gained = $3 \times 365\frac{1}{4} \times 33$, or $36159\frac{3}{4}$ hrs.
= 4 yrs. 180 d. 15 hrs. 45 min.

(2) The train travels $\frac{66 \times 20 \times 60 \times 36}{39{\cdot}3708}$ metres,

or $\frac{14256}{196{\cdot}8540}$ kilom., or 72·4... kilom. in an hour.

2. (1) 16 tons, 3 cwt. = 323 cwt.

Each two persons receive $4\frac{1}{4}$ cwt.

Now $323 \div 4\frac{1}{4} = 19 \times 4 = 76$;

$\therefore$ No. of persons = $76 \times 2 = 152$.

(2)

fr.
411·75
519·09
134·35
606·29
64·
1735·48 fr.

Now 25·325 fr. = £1;

$$\therefore 1 \text{ fr.} = \frac{1}{25{\cdot}325} \text{ of £1};$$

$$\therefore 1735{\cdot}48 \text{ fr.} = £\frac{1735{\cdot}48}{25{\cdot}325} = £68{\cdot}5\ldots;$$

∴ 7 ten-pound notes must be changed.

(3) $3\frac{1}{2}$ hectol. weigh $\left(\frac{7}{2} \times 94000\right)$ grs. = 329 kilog.;

∴ cask and wine weigh (17·45 + 329) kilog. = 346·45 kilog.

$$\therefore \text{ cost of carriage} = \left(\frac{34645}{10000} \times 430\right) c.$$

$$= 1489{\cdot}735c. = 14fr.\ 90c. \text{ nearly.}$$

3. (1)
$$\begin{array}{r|l}
345 & 624 \ (1 \\
\underline{345} & \\
279 & 345 \ (1 \\
\underline{279} & \\
66 & 279 \ (4 \\
\underline{264} & \\
15 & 66 \ (4 \\
\underline{60} & \\
6 & 15 \ (2 \\
\underline{12} & \\
3 & 6 \ (2 \\
\underline{6} & \\
\end{array}$$

∴ 3 is the G. C. M. required,

and L. C. M. required $= \frac{345 \times 624}{3} = 115 \times 624 = 71760.$

(2) $4 \mid \underline{8,\ 8,\ 12,\ 20}$
$\quad\quad 2,\ 3,\ 5$

∴ L. C. M. = 4 × 2 × 3 × 5 = 120;

∴ No. of sixpences required = 120.

4. (1) $(2\frac{1}{6}+3\frac{2}{9}+5\frac{3}{5})-(5\frac{4}{5}+\frac{3}{8}+\frac{7}{12}+2\frac{5}{24})$

$$=\left(10+\frac{72+80+135}{360}\right)-\left(7+\frac{32+27+42+15}{72}\right)$$

$$=10\tfrac{287}{360}-7\tfrac{116}{72}=(10-8)+\left(\frac{287}{360}-\frac{220}{360}\right)$$

$$=2\tfrac{67}{360}.$$

(2) $$\frac{1\frac{1}{2}\text{ of }\frac{1\frac{1}{2}}{2\frac{1}{4}}}{3\frac{1}{3}}\text{ of }\frac{\frac{1}{2}\text{ of }\frac{4}{5}}{4\frac{1}{2}\text{ of }\frac{1}{5}}\div\frac{\frac{1}{2}\text{ of }\frac{\frac{4}{5}}{\frac{3}{7}}}{\frac{3}{4}}$$

$$=\left(\frac{\frac{3}{2}}{\frac{9}{4}}\text{ of }\frac{4}{9}\times\frac{4}{9}\times\frac{3}{10}\text{ of }\frac{1}{2}\text{ of }\frac{4}{5}\times\frac{\frac{5}{7}}{9}\text{ of }\frac{5}{1}\right)$$

$$\div\left(\frac{1}{2}\text{ of }\frac{4}{5}\times\frac{7}{8}\times\frac{4}{8}\right)$$

$$=\frac{\frac{1}{4}\times\frac{1}{4}\times\frac{3}{4}\times\frac{1}{4}}{\frac{3}{4}\times\frac{3}{4}\times\frac{2}{5}\times\frac{5}{2}\times\frac{2}{4}\times\frac{3}{4}\times3}\times\frac{2\times\frac{5}{7}\times\frac{3}{4}\times\frac{3}{4}}{\frac{1}{4}\times7\times\frac{1}{4}}$$

$$=\frac{2}{3\times7}=\frac{2}{21}.$$

5. (1) A's share + B's share $=\left(\frac{1}{3}+\frac{7}{15}\right)$ or $\frac{4}{5}$ of ship;

$\therefore$ C's share $=\frac{1}{5}$ of ship;

value of C's share $=\frac{1}{5}$ of £45000 = £9000.

(2) A boy can dig $\frac{1}{6}$ ro. in 1 day,

a man ..... $\frac{2}{9}$ .....;

$\therefore$ 2 men and 3 boys can dig

$\left(\frac{4}{9}+\frac{1}{2}\right)$ or $\frac{17}{18}$ ro. in 1 day;

$\therefore$ No. of days required $=\frac{34}{\frac{17}{18}}=\frac{34\times18}{17}=36.$

6. (1)

$$\begin{array}{r|l} \cdot0019 & 76\cdot5700 \ (40300 \\ & \underline{76} \\ & \quad 57 \\ & \quad \underline{57} \end{array}$$

$\frac{3}{7}$ of $\cdot0008568 = 3 \times \cdot0001224 = \cdot0003672$;

$\therefore$ product $= 40300 \times \cdot0003672$
$= 14\cdot79816.$

(2) $\frac{3}{4}$ of $\frac{1}{9\frac{1}{2}}$ of £1. 18*s.* $= \frac{3}{4}$ of $\frac{2}{19}$ of 38*s.* $= 3s.$

$\frac{2}{3}$ of $\cdot375$ of 15*s.* $= \frac{2}{3}$ of $\frac{3}{8}$ of 15*s.* $= 3s.\ 9d.$

$\frac{2}{5}$ of $\cdot4\dot{2}\dot{9}$ of 8*s.* 3*d.* $= \frac{2}{5}$ of $\frac{425}{990}$ of 99*d.* $= 1s.\ 5d.$;

$\therefore$ sum $= 3s. + 3s.\ 9d. + 1s.\ 5d. = 8s.\ 2d.$

$$\begin{array}{r|l} 12 & 2\cdot \\ 100 & \underline{8\cdot1666} \\ & \cdot0816\dot{6} \end{array}$$

Ans. $= \cdot0816\dot{6}$.

7. (1) (dist.)^2 in feet $= (24)^2 + (45)^2 = 576 + 2025 = 2601$,

$$\begin{array}{r|l} & 26\dot{0}1 \ (51 \\ & 25 \\ 101 & \underline{101} \\ & \quad 101 \end{array}$$

$\therefore$ Ans. $= 51$ feet.

(2) £275. 12*s.* 6*d.* $= 11025$ sixpences,

£87. 12*s.* 1*d.* $= 21025d.$

$$\begin{array}{r|l} & 1\dot{1}0\dot{2}\dot{5} \ (105 \\ & 1 \\ 205 & \underline{1025} \\ & \quad 1025 \end{array} \qquad \begin{array}{r|l} & 2\dot{1}0\dot{2}\dot{5} \ (145 \\ & 1 \\ 24 & \underline{110} \\ & \quad 96 \\ 285 & \underline{1425} \\ & \quad 1425 \end{array}$$

$\therefore$ No. of boys in the upper forms $= 105$,
..... lower ..... $= 145$;
$\therefore$ No. of boys in the school $= 250$.

8. (1) Average income-tax for the year

$$= \frac{9+7}{2}\,d. = 8d.$$

$$\text{Income-tax} = \left(2063 \times 8 + \frac{45}{240} \times 8\right)d. = £68.\ 15s.\ 5\tfrac{1}{2}d.;$$

$\therefore$ net income $= £2063.\ 8s.\ 9d. - £68.\ 15s.\ 5\tfrac{1}{2}d.$
$= £1994.\ 8s.\ 3\tfrac{1}{2}d.$

The carriage of 120 bales, of 90 kilog. each, costs $450\,fr.$

$\therefore$ ..... 1 ..... $5\,fr.$

$\therefore$ ..... 1 ..... 1 ..... $\frac{1}{24}\,fr.$

$\therefore$ ..... 80 ..... $\frac{10}{3}\,fr.$

$\therefore$ ..... 340 ..... 80 ..... $\frac{3400}{3}\,fr.$

or $1133\,fr.\ 33c.$ nearly.

Ex. II. Page 99.

1. (1) 5 gal. $\div$ 5 qts. $= 20$ qts. $\div 4$ qts. $= 4$;
6 hrs. $\times 4 = 24$ hrs.

Again, 5 qts. $\div$ 5 gal. $= \frac{1}{4}$;

$\therefore$ 6 hrs. $\times \frac{1}{4} = 1$ hr. 30 min.

(2) 6 pumps discharge 64800 gal. in 12 hrs.,
$\therefore$ ..... 5400 ..... 1...
$\therefore$ 1 ..... 900 .....
$\therefore$ ..... 7200 ..... 8...
$\therefore$ 10 ..... 72000 .....

$$= \frac{72000 \times 8}{1{\cdot}76077}\ \text{lit.} = 327129{\cdot}6\ \text{lit.}$$

2. (1)

2	48,	64,	27,	81,	88, 110, 165
8	24,	32,		81,	55, 165
3	8,	4,		81,	55, 165
		4,		27,	55, 55

$\therefore$ L. C. M. $= 2 \times 8 \times 3 \times 4 \times 27 \times 55 = 285120$.

(2) Find the L. C. M. of the sums named, expressed in pence,

4	1,	12,	24,	30,	60,	240,	252
3					60,	60,	63
						20,	21

L. C. M. $= 4 \times 3 \times 20 \times 21$;

$\therefore$ least sum of money $= (4 \times 3 \times 20 \times 21)d. = £21$.

3. (1) $\frac{2}{7}$ of $\frac{1 - \frac{2}{7}}{2} + \frac{4}{5} \times \frac{1}{10} + \frac{3}{5}$ of $\left(\frac{1}{2} + \frac{11}{14}\right) + \frac{3}{70}$ of $1\frac{8}{35}$

$= \frac{2}{7}$ of $\frac{5}{14} + \frac{2}{25} + \frac{3}{5}$ of $\left(\frac{18}{14}\right) + \frac{3}{70}$ of $\frac{38}{35}$

$= \frac{5}{49} + \frac{2}{25} + \frac{27}{35} + \frac{57}{35 \times 35}$

$= \frac{125 + 98 + 945 + 57}{35 \times 35} = \frac{1225}{1225} = 1.$

(2) $\dfrac{\frac{1}{2} + 1}{\frac{1}{4} + \frac{1}{5}} - \dfrac{\frac{1}{10} + 1}{\frac{1}{2} + \frac{1}{4}}$

$= \frac{1}{2} + \frac{5}{21} - \frac{1}{10} + \frac{4}{9}$

$= \frac{21}{47} - \frac{9}{94} = \frac{42 - 9}{94} = \frac{33}{94}$.

4. (1) Each part $= \frac{1}{3} \div 4 = \frac{1}{12}$;

$\therefore$ No. of parts $= \frac{5}{12} \div \frac{1}{12} = 5$.

(2) Wheat 56*s.* a qr., lab. receives 12*s.*;

$\therefore$ ..... 1*s.* ..... ought to receive $\frac{12}{56}$*s.*;

$\therefore$ ..... £2. 12*s.* 6*d.* ..... $\frac{3}{14}$ of $52\frac{1}{2}$*s.* = 11*s.* 3*d.*

		£	*s.*	*d.*
5.	$19\frac{3}{4}$ yds. of silk at 6*s.* 7*d.* a yd. . . .	= 6	10	$0\frac{1}{4}$
	$26\frac{5}{7}$ yds. of lace at 4*s.* 6*d.* a yd. . . .	= 5	19	6
	$8\frac{1}{2}$ doz. pairs of gloves at 3*s.* 9*d.* a pair .	= 19	2	6
	$25\frac{1}{4}$ yds. of trimming at 2*s.* 10*d.* a yd. .	= 3	11	$6\frac{1}{2}$
	23 yds. of embroidery at 6*s.* $0\frac{3}{4}$*d.* a yd. .	= 6	19	$5\frac{1}{4}$
	9 doz. and 3 handkerchiefs at 4*s.* 11*d.* each	= 27	5	9
	$11\frac{1}{2}$ yds. of blonde at 4*s.* $9\frac{3}{4}$*d.* a yd. . .	= 2	14	$6\frac{1}{2}$
	$20\frac{3}{4}$ yds. of silk velvet at 17*s.* 6*d.* a yd. .	= 18	3	$1\frac{1}{2}$
	$19\frac{1}{2}$ yds. of sarcenet at 3*s.* $6\frac{1}{2}$*d.* a yd. .	= 3	8	$8\frac{1}{2}$
	A sealskin cloak	= 21	0	0
		114	15	$1\frac{1}{2}$

$\therefore$ Ans. = £120 − £114. 15*s.* $1\frac{1}{2}$*d.* = £5. 4*s.* $10\frac{1}{2}$*d.*

6. (1) $\cdot 2615384$ of £6. 10*s.* $= \left(\frac{2615832}{9999990} \text{ of } 130\right)$*s.* = 34*s.*

= £1. 14*s.*;

$\cdot 54$ of $\cdot 027$ of a mile $= \left(\frac{54}{99} \times \frac{27}{990} \times 1760\right)$ yds.

$= \frac{288}{11}$ yds. = 26 yds. $6\frac{6}{11}$ in.

(2) $\cdot 428571 = \frac{3}{7}$, and $\cdot 4583 = \frac{11}{24}$;

$\therefore$ If $\frac{3}{7}$ of an estate be worth $(450 \times 25 \cdot 125)fr.$

$\frac{1}{7}$ ..... is ..... $(150 \times 25 \cdot 125)fr.$

$\therefore$ the estate is worth $(150 \times 25 \cdot 125 \times 7)fr.$

$\therefore \frac{11}{24}$ of ..... $\left(\frac{11}{24} \text{ of } 150 \times 25 \cdot 125 \times 7\right)fr.$

$= \frac{1}{4}$ of $48365 \cdot 625fr.$

$= 12091fr.$ 40*c.* nearly.

7. (1) 5 balls of lead = 9 balls of iron,
..... = 21 balls of marble;
$\therefore$ 35 ..... = (21×7) or 147 balls of marble.

(2) When the minute-hand has gained 60 minutes of the hour-hand, the hands will be together again.

Now $55'$ is gained by minute-hand in $60'$;

$\therefore$ $1'$ ..... $\frac{12'}{11}$;

$\therefore$ $60'$ ..... $\left(\frac{12 \times 60}{11}\right)'$;

$\therefore$ ..... $65\frac{5}{11}'$;

$\therefore$ time required $= 5\frac{5}{11}'$ past 1 o'clock.

(3) He has 19*s.* 2*d.* or 230*d.*, after paying rate on £1 or 240*d.*

$\therefore$ ..... 1*d.* ..... $\frac{240}{230}d.$;

$\therefore$ ..... £1 ..... $£\frac{24}{23}$;

$\therefore$ ..... £862. 10*s.* ..... $£\left(\frac{24}{23} \text{ of } 862\frac{1}{2}\right)$
$= £900.$

(4) 9*d.* in the £ increased his in.-tax by (£52. 10*s.* − £18. 15*s.*) or £33. 15*s.*;

$\therefore$ sum on which he paid $= £\frac{675}{\frac{3}{4}} = £900,$

Now £900 pays £18. 15*s.* or 4500*d.* for in.-tax,

$\therefore$ £1 ..... 5*d.* .....

8. (1)

$8024 \cdot 024008 \,(20 \cdot 02$
8

$3 \times (200)^2 = 120000$	24024008
$3 \times (2000)^2 = 12000000$	
$3 \times 2000 \times 2 = 12000$	
$2^2 = 4$	
12012004	
2	
24024008	24024008

$$\dot{0}0\dot{0}0\dot{3}0\dot{0}0\dot{0}0\dot{0}0\dot{0}\ (\cdot 0310\ldots$$

$3\times 3^2=27$	27 | 3000
$3\times(30)^2=2700$	
$3\times 30\times 1=\ 90$	
$1^2=\ 1$	
2791	2791
$3\times(31)^2=2883$	209000

(2)

sc.	ro.	po.	yds.
201	1	3	$28\frac{1}{4}$
4			
805			
40			
32203			
$30\frac{1}{4}$			
966090			
8050·75			
28·25			
974169			

$\dot{9}\dot{7}\dot{4}\dot{1}\dot{6}\dot{9}\ (987$

81

188	1641
	1504
1967	13769
	13769

$\therefore$ length of side of field = 987 yds.

(3) 100 pears cost $50d.$, 150 apples cost $75d.$;

$\therefore$ whole cost $= 125d.$

I sell the pears for $75d.$, the apples for $100d.$;

$\therefore$ I sell the whole for $175d.$;

$\therefore$ gain $= (175-125)d. = 50d. = 4s.\ 2d.$

Also, since by investing $125d.$ I gain $50d.$,

..... $1d.$ ..... $\frac{50}{125}d.$,

..... £1 ..... £$\frac{50}{125}$,

..... £100 ..... £$\frac{100\times 50}{125}$ = £40.

Ex. III. Page 102.

1. (1) $\frac{1}{12}$ is alloy,

alloy in 3 oz. 15 dwts. of standard gold $= \frac{1}{12}$ of 3 oz. 5 dwts.

$= 5$ dwts. 10 grs.

(2) No. of sq. m. in yard $= \frac{783\frac{9}{40}}{\frac{9}{40}} = 3481$;

$$\begin{array}{r|l} & 3481 \,(59 \\ & 25 \\ \hline 109 & 981 \\ & 981 \\ \hline & \end{array}$$

$\therefore$ side of square is 59 m.

2. (1) $84 - 44 = 40$;

By the question,

40 oranges are worth 2*s.* 6*d.*;

$\therefore$ 1 orange is worth $\frac{1}{40}$ of 2*s.* 6*d.* $= \frac{3}{4}d.$

(2) L. C. M. of 32 and $36 = 8 \times 9 \times 4$;

$$\therefore \text{Ans.} = \frac{36 \times 64}{8 \times 9 \times 4} = 8.$$

3. (1) $\frac{3}{4} + \frac{4}{5} + \frac{5}{6} = \frac{45 + 48 + 50}{60} = \frac{143}{60}$;

$$\frac{9}{10} \text{ of } \frac{21}{50} - \frac{9}{10} \text{ of } \frac{1}{50} = \frac{9}{10} \text{ of } \frac{20}{50}.$$

$$\text{Now } \frac{143}{60} \times \frac{9}{10} \text{ of } \frac{2}{5} \div 333\tfrac{1}{3} = \frac{143}{30} \times \frac{9}{10} \times \frac{1}{5} \times \frac{3}{1000}$$

$$= \frac{2574}{1000000} = \cdot 002574.$$

(2) No. of times $= \frac{6}{55}$ of $\frac{3}{20}$ of $\frac{77}{72}$ of $40 \div \frac{4}{15}$ of $\frac{3}{40}$ of $\frac{30}{7} \times 21$

$$= \frac{6}{55} \times \frac{3}{20} \times \frac{77}{72} \times \frac{40}{1} \times \frac{15}{4} \times \frac{40}{3} \times \frac{7}{30} \times \frac{1}{21} = \frac{7}{18}.$$

(3) $\frac{\cdot 003125 \times \cdot 48}{\cdot 0000125}$ of $\cdot 06$ of $4\cdot 2$ of a guinea

$$= \left(\frac{3125 \times 48}{125 \times 10} \times \frac{6}{100} \text{ of } \frac{42}{10} \times 21\right) \text{s.}$$

$$= \frac{12 \times 6 \times 42 \times 21}{100} \text{ s.;}$$

$\therefore \frac{\cdot 003125 \times \cdot 48}{\cdot 0000125}$ of $\cdot 06$ of $4\cdot 2$ of a guinea

$$= \frac{12 \times 6 \times 42 \times 21}{100} \times \frac{1}{20 \times 100} \text{ of £100}$$

$$= \frac{31752}{100000} \text{ of £100;}$$

$\therefore$ dec. required $= \cdot 31752$.

4. (1) $\frac{69}{9}$ or $7\frac{2}{3}$ = no. of hrs. the coach is travelling;

$\therefore 8\frac{1}{2} =$ ..... train .....

$\therefore \frac{69}{8\frac{1}{2}}$ or $\frac{69 \times 3}{11}$ = no. of mi. per hr. at which train travels;

$\therefore$ train travels $\frac{\frac{69 \times 3}{11}}{9}$ or $\frac{23}{11}$ or $2\frac{1}{11}$ times as fast as coach.

(2) By the question, A does $\frac{2}{3}$ of work in 4 hours,

B does $\frac{3}{4}$ of $\frac{1}{3}$ in 1 hr.;

$\therefore$ part of work done by A and $B = \frac{2}{3} + \frac{1}{4} = \frac{11}{12}$;

$\therefore$ C does $\frac{1}{12}$ in 20 min.

Representing the work by unity, or 1,

in 1 hour A does $\frac{1}{6}$ part of the work,

..... B ..... $\frac{1}{4}$ .....,

..... C ..... $\frac{1}{4}$ .....,

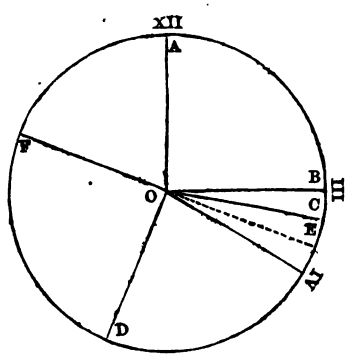
.....$A+B+C$ do $\left(\frac{1}{6}+\frac{1}{4}+\frac{1}{4}\right)$ part of the work,

$$=\frac{8}{12};$$

$\therefore$ No. of hours in which $A+B+C$ would finish the work

$$=\frac{1}{\frac{8}{12}}=\frac{12}{8}=1\tfrac{1}{2}.$$

(3) 1st. Let OC and OD represent the positions of the hour and minute-hands of the clock when they are 15′ apart between 3 and 4 o'clock.



In the time that the hour-hand has passed over BC, the minute-hand has passed over AD, and the minute-hand travels 12 times as fast as the hour-hand;

$$\therefore 12BC = AD = AB + BC + CD$$
$$= 15' + BC + 15'$$
$$= 30' + BC;$$

$\therefore$ 12 times BC − once BC = 30′ + once BC − once BC;

$$\therefore 11BC = 30';$$

$$\therefore BC = \frac{30'}{11} = 2\tfrac{8}{11}';$$

$\therefore$ time required = $30' + BC = 32\tfrac{8}{11}'$ past 3.

The hour and minute-hands are also 15′ apart at 3 o'clock.

2nd. Let OE and OF represent the positions of the hour and minute-hands of the clock when they are 30′ apart.

Then $12BE = AF = AB + BE + EF$
$= 15' + BE + 30';$

$\therefore$ as before, $11BE = 45'$, or $BE = 4\tfrac{1}{11}';$

$\therefore AF = 49\tfrac{1}{11}'$ past 3 o'clock.

5. (1) Cost of land $= \left(\frac{11960{\cdot}3326 \times 9}{2}\right)s. = 53821{\cdot}4967s.;$

$\therefore$ 1 hectare of land must sell for $(53821{\cdot}4967 + 3005)s.$,
or $56826{\cdot}4967s.;$

$\therefore$ 1 yd. ..... $\frac{56826{\cdot}4967}{11960{\cdot}3326}s.$

$= 4s.\ 9d.$ nearly.

(2) 7 litres of dearer cost $4fr. 50c. \times 7 = 3150c.$,
5 ..... cheaper .... $2fr. 35c. \times 5 = 1175c.;$

$\therefore$ 12 litres of spirit cost $4325c.$,

$\frac{1}{4}$ of $4325c. = 1081{\cdot}25c.;$

$\therefore$ 12 litres of spirit must sell for $5406{\cdot}25c.$,
or $12 \times 1{\cdot}76077$ pts. .....;

$\therefore$ 1 pt. must sell for $\frac{5406{\cdot}25}{12 \times 1{\cdot}76077}c.$, or $2fr.\ 55c.$ nearly.

(3) £117. 10*s.* ÷ 2 = £58. 15*s.* = 235 crowns,
£28. 10*s.* = £28½ = 57 half-sovs.,
remainder = £117. 10*s.* − £87. 5*s.* = £30. 5*s.*;
£30. 5*s.* ÷ 5 = £6. 1*s.* = 121 shillings,
remainder = £30. 5*s.* − £6. 1*s.* = £24. 4*s.*;
£24. 4*s.* = 484*s.* × 3, or 1452 four-pennies.

6. (1) 5·136 dwts. of standard gold = £1;

∴ 1 dwt. ..... $= £\frac{1}{5\cdot136}$;

∴ 4 oz. ..... $= £\frac{4\times20}{5\cdot136}$

$= \frac{4\times20\times20}{5\cdot136}$ *s.*

= in weight $\frac{4\times20\times20}{5\cdot136\times66}$ lbs. Troy

= 4 lbs. 8 oz. 12 dwts. $19\frac{901}{1177}$ grs.

(2) $£\frac{52}{3}$, oats 4*s.* a bus., will keep for 63 d., 13 horses,

$£\frac{52}{3}$, oats 1*s.* a bus., will keep for 1 d., (13 × 4 × 63)...

£1, ... $\frac{13\times4\times63\times3}{52}$ ...

£1, ... 4*s.* 6*d.* ..... $\frac{63\times3\times2}{9}$ ...

£1, ... 56 d., $\frac{63\times3\times2}{9\times56}$ ...

£10⅔, ... $\frac{63\times3\times2}{9\times56}\times10\frac{2}{3} = 8$ horses.

(3) On every £200 he pays 10*s.*;
∴ insurance amounts to (10 × 35)*s.* = £17. 10*s.*

7. (1) No. of men $= 50 \times 4 + 50 \times 4 + 42 \times 4 + 42 \times 4$
$= 200 + 200 + 168 + 168 = 736.$

(2) 1st lot cost $(1{\cdot}75 \times 80)$ *fr.* $= 140$ *fr.*
2nd ..... $(2{\cdot}05 \times 100)$ *fr.* $= 205$ *fr.*
3rd ..... $(4{\cdot}5 \times 60)$ *fr.* $= 270$ *fr.*;
$\therefore$ 340 kilog. cost 615 *fr.*;

$\therefore$ 1 oz. cost $\frac{61500}{240 \times 35{\cdot}27375}$ *c.*, or rather more than 7*c.*

(3) Coach travels 9 mi. in 1 hr.;

$\therefore$ ..... 11 mi. in $\frac{11}{9}$ hr.;

$\therefore$ Train..... 23 mi. in $\frac{11}{9}$ hr.;

$\therefore$ ..... (23×6) mi. in $\left(\frac{11}{9} \times 6\right)$ hrs.,
or $\frac{22}{3}$ hrs.

Coach travels 138 mi. in $\frac{138}{9}$ hrs.;

$\therefore$ time saved $= \left(\frac{138}{9} - \frac{66}{9}\right)$ hrs. $= \frac{72}{9}$ hrs. $= 8$ hrs.

8. (1) Weight of three ingots of gold
$= (2{\cdot}25 + 1{\cdot}40 + 3{\cdot}07)$ kilog.
$= 6{\cdot}72$ kilog.;

Weight of three ingots of silver $= (8{\cdot}35 + 13{\cdot}002 + 26)$ kilog.
$= 47{\cdot}352$ kilog.;

$\therefore$ value of gold + value of silver

$$= \left(\frac{6{\cdot}72 \times 15432{\cdot}3487}{24 \times 20} \times 72 + \frac{47{\cdot}352 \times 15432{\cdot}3487}{24 \times 20} \times 5\right)s.$$

$$= \frac{15432{\cdot}3487}{24 \times 20} \times (6{\cdot}72 \times 72 + 47{\cdot}352 \times 5)s.$$

$$= \frac{15432{\cdot}3487}{24 \times 20} \times \left(\frac{6{\cdot}72 \times 72 + 47{\cdot}352 \times 5}{20} \times 25\right)fr.$$

$$= \frac{15432{\cdot}3487 \times 180{\cdot}15}{24 \times 4}\,fr.$$

$$= \frac{2780137{\cdot}618305}{24 \times 4}\,fr.$$

$$= 28959\,fr.\ 76{\cdot}685734375c.$$

(2) *C*'s share + $\frac{5}{6}$ *C*'s share + $\frac{2}{3}$ of $\frac{5}{6}$ of *C*'s share = 107 *fr.* 50 *c.*

or $\left(1 + \frac{5}{6} + \frac{5}{9}\right)$ of *C*'s share = 107·50 *fr.*

or $\frac{43}{18}$ of *C*'s share = 107·50 *fr.*;

$\therefore$ *C*'s share = $\left(\frac{18}{43}\text{ of }107{\cdot}5\right)fr.$

$= 45\,fr.$;

$\therefore$ *B*'s share = $\frac{5}{6}$ of $45\,fr. = 37\,fr.\ 50c.$

and *A*'s ..... = $\frac{2}{3}$ of $37\,fr.\ 50c. = 25\,fr.$

9. (1) 4 hectol. of wine cost $(60 \times 400)c.$ or 24000 *c.*;
selling price of wine = $(24000 + 3000)c.$
$= 27000c.$;

No. of litres to be sold = $\frac{27000}{45} = 600$;

$\therefore$ he must add $(600 - 250)$ or 350 litres of water.

(2) 20 men + 64 women + 96 children = £960. 4*s*. 4*d*.

Now 64 women = 32 men,

96 children = 32 women = 16 men;

$\therefore$ 20 men + 32 men + 16 men = £960. 4*s*. 4*d*.;

$\therefore$ 68 men = £960. 4*s*. 4*d*.;

$\therefore$ each man has $\frac{1}{68}$ of £960. 4*s*. 4*d*.

or £14. 2*s*. 5*d*.;

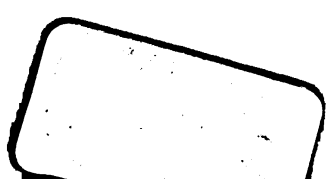
$\therefore$ each woman has $\frac{1}{2}$ of £14. 2*s*. 5*d*., or £7. 1*s*. $2\frac{1}{2}$*d*.,

and each child has $\frac{32}{96}$ or $\frac{1}{3}$ of £7. 1*s*. $2\frac{1}{2}$*d*.

or £2. 7*s*. $0\frac{5}{6}$*d*. $\frac{1}{3}$*q*.

(3) 44 lbs. 11 oz. 11 dwts. 16 grs. Troy = 259000 grs.;

$\therefore$ No. of lbs. Avoird. $= \frac{259000}{7000} = 37$;

No. of kilog. $= \frac{259000}{15432 \cdot 3487} = 16$ kilog. 7 hectog. 8 décag. 2·9 gr.

CAMBRIDGE: PRINTED AT THE UNIVERSITY PRESS.